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PARK CITY WATER RESOURCES STUDY

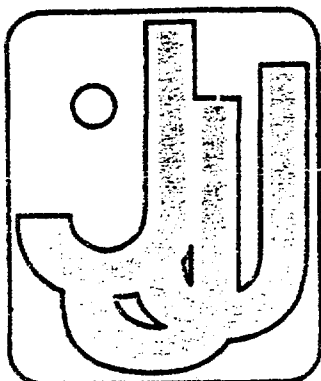
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FOR

PARK CITY MUNICIPAL CORPORATION



J.J. Johnson & Associates

Civil Engineering
Land Planning
Surveying

W A T E R R E S O U R C E S S T U D Y

Park City Municipal Corporation

November 1982

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I. INTRODUCTION

A. Purpose

B. Scope

I. INTRODUCTION

A. Purpose

During the summer of 1981, the resolution of Park City's water supply and water rights problem became paramount in the eyes of Park City officials, local developers and residents. Events which helped bring about this concern were the Park Meadows Well lawsuit and the limitation on use of the Spiro Tunnel water system.

The purpose of this Study is to identify, assess and evaluate Park City's present and future water supply requirements; investigate its existing and potential water resources; and clearly explain water rights held by the City.

This Study will further analyze several water supply improvement alternatives that can be taken to expand and upgrade the City's present supply system. Costs estimates and annual cost analyses have been included for each alternative.

All water source requirements, water quality mandates, and water rights laws in effect today have been incorporated in the long-range forecasts and recommendations.

B. Scope

This Study was confined to the three possible service areas noted as Park City Service Areas on Exhibit 1, including any property in close physical proximity that could eventually be serviced by the Park City municipal water system.

The Study Area was taken as the adopted Annexation Boundary, service area B, and is shown in Exhibit 2, in Section X.

Climate, topography, geology, surface water, and ground water features are included in Appendix A-1.

II. DEMOGRAPHIC ANALYSIS

- A. Analysis Criteria
- B. The Service Areas
 - 1. 1982 Park City Limits
 - 2. Annexation Boundary
 - 3. Long Range Service Area
- C. The Study Area
- D. Forecast of Populations and Developed Units

II. DEMOGRAPHIC ANALYSIS

Park City, once renown for its prolific mining activities, has become a major recreational center in the Intermountain West. At the turn of the century, the discovery of its rich abundance of mineral resources contributed to Park City's rising population, reaching 6,000 people by 1929. As a prelude to the ski industry potential, the Snowpark Ski Area was developed in 1945. However, as the mining industry declined, so did the population to a low of 1,400 in 1960. The Snowpark Ski Area became a casualty of Park City's economic lull. Then in 1963, large-scale skiing was introduced to the area with the development of the Treasure Mountain Resort. In 1971, this resort changed ownership and became Park City Resort. Growth has not stopped accelerating. In recent years, Park City has developed other recreational activities, including golf and tennis. In 1981, the Deer Valley Resort began operations contributing to the area's already popular skiing attraction. This growing recreational market has profoundly affected land development. The incentives to develop continue, and as the recreational trend increases, so will the attraction to visit or live permanently in Park City.

A. Analysis Criteria

Several detailed population growth estimates have recently arisen out of the marked expansion of population and land use in the seventies. Predictions have generally been based upon the collective effects of seven variables:

- 1) Potential building areas/sites;
- 2) Presently planned developments;
- 3) Past growth;
- 4) Building permits issued;
- 5) Recreational potential;
- 6) Commercial/industrial potential;
- 7) Availability of public services and utilities, and private services.

The future population of the Park City Study Area, including Snyderville Basin, is directly dependent on a combination of several internal and external development sources:

- 1) Suburban residential development:
 - a) Primary home building;
 - b) Secondary home building;
- 2) Industrial development;
- 3) Energy/overthrust belt development;
- 4) Continued expansion of skiing and tourism activities and commercial support services.

The interdependence of the latter four variables is based on both national and regional economics. Without elaborating on the various intricacies of precise demographics, the recent

development and population projections generally use either potential housing supply or potential housing demand for growth.

The primary difference between a housing supply and a housing demand growth demography rests with the degree to which the four development sources are weighed. A potential supply projection acknowledges the four development sources as inevitable contributions to population growth. There is not, however, a specific timetable or projected economic trend commensurate with the potential development growth. The primary concern rests with the capacity of the areas for development and how great a population they can contain or supply. The potential supply projections, therefore, first calculate the population an area can support with the assumption that the four development sources will be maximized.

A demand growth demography applies the four development sources as dependents to the existing and projected economic fluctuations of the region and the geo-economic feasibilities of the specific types of development. The potential for development and population growth corresponds to the economic environment which also determines the extent of the four development sources. Therefore, in establishing a forecasting model, the housing demand demography uses economic growth as a function of time. As a result, the use of potential housing supply as a growth predictor projects a significantly higher total population for the Park City/Snyderville area than the more conservative approach of potential housing demand. This Study uses the more realistic housing demand approach.

Population projections are compared for several studies completed over the previous ten years in Tables 1 and 2 in Section X.

B. The Service Areas

Three defined service areas are recognized in this Study. Each is unique in itself and reflects certain water system requirements and needed capital improvements. Two service areas are grouped together for comparison purposes for each time frame considered. Such comparisons will aid Park City in its efforts to plan for water system improvements related to anticipated development.

1) 1982 Park City Limits

The first and smallest area considered is the current physical corporate boundary of Park City. The same limits for this area were maintained through this Study to the year 2020. It is not implied or recommended that the limits for Park City remain as those taken for this 1982 City limits boundary.

2) Annexation Boundary

Following countless hours of meetings and consultation, the Park City Council decided upon a physical perimeter for the future City limits of Park City. At the request of the Council, this Study will use the actual annexation boundary adopted by Park City as the Study Area. The boundary is realistic and very useful in planning further water system improvements anticipated for Park City. It is recommended that the City concentrate their short term planning upon the Annexation boundary.

3) Long-Range Service Area

The most comprehensive service area in the vicinity of Park City is outlined in Exhibit 2. This boundary is intended to represent the physical limits of long-term development in the Park City area. It is not intended to depict future City limits. Several important factors, including the intentions of nearby developers outside the current City limits, the planning concerns of Snyderville and Summit County, and experiences of other resort towns in similar circumstances, have contributed to the boundary set for this service area.

It is recommended that Park City implement this service area in its long-term water planning efforts.

C. The Study Area

The annexation boundary adopted by Park City in 1982 was taken as the Study Area. Exhibit 2 in Section X outlines its physical boundaries.

The Study Area has been broken down into nine (9) sub-areas:

- 1) Old Town Park City, including the Park City Resort base complex area and hillsides.
- 2) North Park City, including the Thaynes Canyon Subdivision, Park Meadows area, commercial area (Holiday/Prospector) and Prospector Developments.

- 3) Deer Valley, including Snow Park, the Deer Valley Resort, the Solamere Development (north Deer Valley), and the Masonic Hill area.
- 4) Flagstaff Mountain, including Upper Empire Canyon and Flagstaff Mountain.
- 5) Thaynes Canyon, including all property west of the existing Park City limits and east of the Study Area boundary. The lower slopes of the Park City Ski Resort are included in sub-Area 1.
- 6) Iron Mountain, specifically the northern slopes of Iron Mountain and Iron Canyon.
- 7) Quarry Mountain, including the land immediately northwest of Park City encircling Quarry Mountain and bordering Utah Highway 224 on the west and the Study Area on the north.
- 8) Round Valley, including the proposed Round Valley Development and property northeast of the existing Park City limits, and bordering Utah Highway 248 and U.S. 40 on the south and east, respectively.
- 9) Richardson Flat, including the majority of potential commercial and residential space east of Park City.

D. Forecast of Populations and Developed Units

The following projections reflect a breakdown of the potential development and could vary with isolated land use ordinances and policies as well as with unforeseen economic and development trends:

- 1) Old Town Park City - 83 developed units per year to year 2000.
- 2) North Park City - 56 developed units per year to year 2000.
- 3) Deer Valley - 117 developed units per year to year 2000.
- 4) Flagstaff Mountain - 28 developed units per year to year 2000.
- 5) Thaynes Canyon - 200 units maximum.
- 6) Iron Mountain - 500 units maximum near the base of Iron Mountain.
- 7) Quarry Mountain - 400 units maximum.
- 8) Round Valley - 1,000 units maximum.
- 9) Richardson Flat - 800 units maximum. While this area could become exclusively commercial, there is a potential for hillside developments.

The 1981 residential housing and commercial space has been tabulated by the Park City Planning Staff and is shown in Table 4.

Table 5 in Section X tabulates these unit projections for each sub-area and the Study Area. As a supplement to this Study's projected unit count, Tables 6, 7 and 8 show forecasts for ski season average and peak populations.

Anticipated project development for each service area over time is shown in Table 27. Major forecasts from this table include:

1982 Park City Limits

| | |
|------|-------------|
| 1982 | 3,900 units |
| 2000 | 8,500 units |
| 2020 | 9,500 units |

The Study Area (Annexation Boundary)

| | |
|------|--------------|
| 1982 | 3,900 units |
| 2000 | 10,650 units |
| 2020 | 13,600 units |

III. WATER SOURCE AND WATER RIGHTS REQUIREMENTS

A. Source Requirements

- 1) Indoor
- 2) Outdoor
- 3) Commercial
- 4) Firefighting
- 5) Design Source Flow Rates

B. Water Rights Requirements

- 1) Indoor
- 2) Outdoor
- 3) Discussion of Water Rights Requirements
- 4) Water Rights Calculation
- 5) Design Water Right Requirements

III. WATER SOURCE AND WATER RIGHTS REQUIREMENTS

A. Source Requirements

Fresh drinking water is typically categorized in three specific use demands: indoor, outdoor and commercial. Firefighting water requirements are considered an impact on the municipal water system, but not a typical daily water use.

1) Indoor Demands

Indoor water demand is defined as all water conveyed to culinary fixtures and personal bathing fixtures within the housing unit. Indoor water demand is not the same flow rate and volume registered on the water meter leading to the housing unit. Outdoor water demand is typically registered by this meter as well.

Park City Municipal Corporation is required to provide its water using citizens with water services ordinarily associated with a small community. A comparison of total water use in selected Utah communities appears in Table 3. The literature has also addressed water demands of other resort towns including Vail, Colorado; Snowbird, Utah; and Teton Village, Wyoming (Table 9).

Indoor use demands partially dictate the quantity of flows required from the water sources. At present, the Utah State Department of Health requires a source capability of 800 gallons per day per connection for single family and summer use homes qualifying as potentially year-round residences. This requirement is negotiable with the Department of Health

only if a municipality can verify lower water uses for their service area. Park City Municipal Corporation should gather and present actual water use data to the State Department of Health as soon as possible in an effort to lower their source capacity requirements. A discussion of Park City's obligations to the Department of Health is included in Appendix A-5.

Potential developable units for the Study Area have been forecast and are shown in Table 5 in Section X. Comparisons of selected similar developments (Lam and Hughes, 1980) are shown in Table 9.

Water source capacity requirements based upon State Department of Health criteria have been forecast (Table 10). Source capacity requirements for indoor use based upon an anticipated peak demand of 450 gallons per day per unit have also been forecast for the Study Area (Table 11).

The composite water use requirements for indoor and outdoor demands in the Study Area are shown in Tables 15 and 16. These tables are based upon criteria from the State Engineer and State Department of Health and this Study's findings, respectively. These requirements are for design purposes only and do not necessarily represent average daily consumption.

All projections and forecasts are based upon reasonable engineering judgements and approximations from existing studies, actual water use data, and previous experiences.

2) Outdoor Demands

Outdoor water demand is defined as all water conveyed to fixtures of a residential or commercial space that is used for irrigation of landscaped or naturally vegetated areas associated with that space. Other miscellaneous water use such as inside commercial demands, street cleaning, and dust control will be considered with commercial water usage.

Most permeable areas surrounding residential and commercial spaces rely upon municipal drinking water facilities to supply their landscaping irrigation requirements. The two golf courses in Park City have separate irrigation systems independent of the municipal water system. Should individual water users or groups of users separate their indoor and outdoor facilities completely, an appropriate reduction in Park City's water source delivery requirement could be made. Separate systems would allow for seasonal differences in source capacity requirements.

Outdoor average water demands in this area are generally proportionate to the type and size of the landscaped areas. Approximate water requirements for reasonable vegetation types were included in this analysis.

Specific irrigated areas and their outdoor water requirements will vary slightly due to elevation, aspect (exposure to the sun), soil type, and irrigation methods and durations. An average seasonal water use volume of 1.9 acre-feet for an irrigation season of 150 days (May 15 to October 15) was assumed.

Each sub-area within the Study Area was evaluated as to irrigation acreage potential (Table 13) and a corresponding outdoor water requirement was determined. Variations of landscaping and irrigation methods are limitless. This Study will consider recent water use information for Park City, trends in water use for similar resort towns, and practical engineering judgment for forecasting water requirements due to outdoor water demands in the Park City area.

Based upon the criteria outlined and the assumptions made for outdoor water demand in Park City, the following average daily water requirement was computed:

$$Q = \frac{1.9 \text{ Ac-Ft}}{\text{Season/Ac}} \times \frac{7.48 \text{ Gal}}{\text{Cubic Ft}} \times \frac{43,560 \text{ Sq Ft}}{\text{Acre}} \times \frac{\text{Season}}{150 \text{ Days}} = \frac{4,127 \text{ Gal}}{\text{Day/Ac}}$$

Table 14 includes outdoor water demands based upon approximated potential irrigation acreages for the developed units forecast for the Study Area.

3) Commercial Demands

The third demand use on a municipal water system is commercial space water demands. These spaces vary in purpose and size but will be grouped together for the purposes of this Study.

Table 17 in Section X includes the source demand requirements forecast for the Study Area when based upon anticipated water use per gross square footage. These water

requirements include average demands for office buildings, retail spaces, schools, laundromats, service stations, and other non-residential spaces. Table 12 lists average use of commercial spaces for selected establishments in the Olympus Hills Mall, Salt Lake City, Utah.

Commercial water demand is site specific, with short-term peak flows having the most impact on municipal systems. Peak demands from commercial areas generally occur during different times than peaks from residential areas. Predicting commercial water use in developing areas is not recommended when forecast on a general, long-range basis. Municipalities should design for and locate each major commercial space separately so that its water impacts can be minimized. This Study projects water source demands for commercial spaces in Table 17 on a gross square footage basis, but recommends specific facility water use analysis for distribution system design.

4) Firefighting Demands

The storage water reserved for firefighting is not considered in determining water rights or peak daily source requirements. It is recommended that the fire district responsible for fire protection in Park City contract with a recognized firefighting consultant to perform all necessary professional studies so that an up-to-date comprehensive fire protection report for Park City is realized.

Several general guidelines and recommendations for adequate fire protection facilities in Park City include:

- a) Minimum reservoir size of 500,000 gallons;
- b) Minimum transmission pipe size of 10 inches;
- c) Emergency back-up pumps for all pump stations;
- d) Complete maintenance programs for all water system components, including reservoirs, pipelines, pump stations, and PRV stations;
- e) Budgeted monies for replacement and/or upgrading of worn and defective water system components;
- f) Minimum of two full-time professional firefighters on duty at all times;
- g) Comprehensive inspection and maintenance program for all fire hydrants and fire equipment.

5) Design Source Flow Rates

Table 17 gives a summary of source requirements over time for the Study Area. Each water use type included in the total recommended source capacity design flow rate is summarized below:

- a) Indoor Demands

Design flow rate = 450 gallons per day per unit.

- b) Outdoor Demands

Design flow rate = 4,127 gallons per acre per day.

c) Commercial Demands

Design flow rate = 0.05 gallons per day per square foot.

d) Total Design Unit Flow Rate, Q:

$$Q = (\text{Indoor} + \text{Outdoor} + \text{Commercial})$$

The design flow rate per unit for 1982 averages 847 gallons per day for the Study Area.

B. Water Rights Requirements

A municipality must have adequate water rights to meet its diversion requirements. Water right flow rates are expressed in cubic feet per second (cfs) or gallons per minute (gpm). A municipality must also have adequate water rights to cover the volume of water consumed annually. This volume is expressed in acre-feet (ac.-ft.).

1) Indoor

The Utah State Department of Health, in their "Public Drinking Water Regulations," requires the water supplier to have the legal right to use one half the required source capacity for a one-year period.

For example:

Required source capacity = 450 gpd* per unit

Total units = 1,000

*gallons per day

$$\begin{aligned}\text{Required daily flow} &= 1,000 \text{ units} \times 450 \text{ gpd per unit} \\ &= 450,000 \text{ gpd}\end{aligned}$$

$$\frac{450,000 \text{ gpd}}{1,440 \text{ mpd}^{**}} = 312.5 \text{ gallons per minute for 1,000 units}$$

$$\begin{aligned}\text{Required legal right} &= \frac{1}{2} \times \frac{312.5 \text{ gpm}}{448.9 \text{ gpm/cfs}} \times \frac{1.98 \text{ ac-ft}}{\text{cfs-day}} \times \\ &\quad \frac{365 \text{ days}}{\text{year}} = 251.6 \text{ ac-ft/year}\end{aligned}$$

**minutes per day

2) Outdoor

The typical seasonal diversion requirement for one acre of land in the Park City area was taken as 1.9 acre-feet per acre. This converts to 4,127 gallons per day per acre for the irrigation season. The average irrigated area on a Park City lot is 0.09 acre. (This figure was derived by dividing the total acres for 1982 in Table 13 by the total number of 1982 units, i.e. 365 acres divided by 3,900 units = 0.09 acres per unit. This is a composite figure of very small Old Town lots, multi-family units and large Park Meadows and Thaynes Canyon lots.) Therefore, the average weighted outdoor daily water use is:

$$0.09 \text{ acre} \times \frac{4,127 \text{ gpd}}{\text{acre}} = 371 \frac{\text{gpd}}{\text{unit}} \text{ for 1982}$$

3) Discussion of Water Rights Requirements

Park City might justify a reduced water right requirement due to return flow credits since only 50 to 75 percent of outdoor irrigation water and 2 to 5 percent of indoor domestic water is consumed and unrecoverable. All water treated at the wastewater plants is replaced to the streams for reuse by downstream water users.

Recently, the Utah State Engineer relaxed his water rights requirement for both multi-family and single family in-house use. He is willing to give full return flow credit for any unconsumed water during the non-irrigation season. No return flow credit for indoor use can be given for the irrigation season because in-house water conveyed through the sewage collection system by-passes all the irrigable land between Park City and the Snyderville Basin Sewer Improvement District (SBSID) Treatment Plant. According to the "Proposed Determination of Water Rights on the Weber River System," the irrigation season is six months in the Park City area.

Table 19 indicates the source capacity and water rights surplus/deficit throughout the Study period. Under historic Utah water rights regulations, sheet 1 of Table 19 shows that the 1982 Park City limits would have a water rights deficit of 1,935 acre-feet by year 2020. Sheet 2 indicates a rights deficit of 4,295 acre-feet for the Study Area by year 2020.

Even though the State Engineer might be willing to grant return flow credits and reduce the annual volume requirement of the water rights, Park City must still have the right to divert the required flows from its sources. While this approach is unprecedented in Utah water law, it is common in other states.

According to State statute, another option Park City has is to capture its sewage effluent, treat it and reuse it for municipal purposes.

4) Example Water Rights Calculation

- a) Traditional procedure (see Table 19 - values for the following calculations were derived from 1982 figures):

Outdoor/Irrigation:

For 1982, outdoor/irrigation flow rate = 1,046 gpm.

Flow rate X 5 months* = $\frac{\text{acre-feet}}{\text{year}}$ required

$$\frac{1046 \text{ gpm}}{448.8 \text{ gpm/cfs}} \times \frac{1.98 \text{ ac.-ft.}}{\text{cfs day}} \times 150 \text{ days} = \frac{692 \text{ ac.-ft.}}{\text{year}}$$

*Five months (150 days), not six, is realistic for Park City and is used in this Study.

Indoor/Domestic:

For 1982, indoor/domestic flow rate = 1,219 gpm

Flow rate X 1/2 X 365 days/year =

$$\frac{1,219 \text{ gpm}}{448.8 \text{ gpm/cfs}} \times \frac{1}{2} \times \frac{1.98 \text{ ac.-ft.}}{\text{cfs day}} \times 365 = \frac{982 \text{ ac.-ft.}}{\text{year}}$$

Total (Table 19, sheet 2, 1982 Column, Line 7) =
1,674 ac.-ft.

b) Winter return flow credit procedure:

Of all indoor water diverted during the six-month winter season, approximately 2% is consumed. The remainder is returned to the stream after treatment.

Return flow = (50% X [traditional domestic]) minus
2% X 50% X (traditional domestic).

For the Study Area in 1982,
(50% X 982 ac.-ft.) - (2% X 50% X 982) = 491 - 10 =
481 ac.-ft.

Therefore, the annual water right requirement with
this procedure is:

1,674 ac.-ft. Traditional Requirement
- 481 ac.-ft. Return Flow Credit

1,193 ac.-ft. Water Right Requirement

IV. EXISTING SUPPLY SOURCES

- A. Judge/Anchor Tunnel
- B. Alliance Tunnel
- C. Theriot Spring
- D. Pacific Bridge Well
- E. Spiro Tunnel Gravity Pipeline

IV. EXISTING SUPPLY SOURCES

Since no documented flow rates and record of water production patterns exist, the following sources were evaluated using information supplied by the Park City Public Works Department. The existing flow rate capacities have been reviewed and confirmed by Park City and are taken as accurate for the purposes of this Study.

Table 18 summarizes the total source capacity from the following existing supply sources. Table 28 depicts the number of allowable units per each existing supply source.

A. Judge/Anchor Tunnel

The 1,200 level of the Judge/Anchor Tunnel has historically been a main fresh water supply source for the Park City area. Water originating from the Judge shaft and tunnels west of the shaft were allowed to gravity flow to the east, through the Judge/Anchor Tunnel and into a crude collection box just outside the portal. Pipelines then conveyed the collected mine water to reservoirs serving Park City. Figure 2 in Section X illustrates the water sources and flow directions in the tunnel.

Recent field investigations of the Judge/Anchor Tunnel by individuals from J. J. Johnson & Associates and Park City Municipal Corporation have substantiated previous concerns as to the tunnel's structural integrity and generally deteriorating condition. The tunnel's ability in its present state to efficiently collect and convey mine water to the portal collection box is highly questionable. J. J. Johnson & Associates submitted a report in April 1982 (see Appendix A-4),

to Park City detailing their observations and recommendations. This mining tunnel water source in its present state can only be considered a marginally dependable water resource.

The Judge/Anchor Tunnel, with the recommended reconditioning noted in the April 1982 report and a regular tunnel maintenance program, should be able to provide all water requirements for at least 2,000 full-time Park City homes. Additional source development and expectations beyond those in that study are not recommended.

Chemical analyses of water flowing from the Judge Tunnel source are included in Figures 3 and 4 in Section X.

In August 1982, improvements were made in the Judge/Anchor Tunnel and have increased the flow rate appreciably.

B. Alliance Tunnel

This mining tunnel presently supplements the Judge/Anchor Tunnel water source currently supplying drinking water to the Empire Reservoir and Park City (see Figure 5).

Relative to the Judge/Anchor Tunnel, the Alliance Tunnel contributes a very small percentage of fresh water to Park City. Estimates of flow rates from this source vary from 50 to 200 gpm.

In the early spring of 1981, a small high-pressure pump was installed near the Alliance Tunnel portal for use by Park City Resort Company. An agreement to pump 50 gallons per minute, maximum, was made with Park City Municipal Corporation.

This pump station and high pressure steel transmission line improvement has been approved by Park City and the State Department of Health and does not seem to interfere with the existing Judge Tunnel water source. The Alliance Tunnel has historically been a minor water source and may be called upon for water in the future. The Park City Public Works Department has indicated that the tunnel has deteriorated and is not totally accessible.

Chemical analyses of water flowing from the Alliance Tunnel source are included in Figures 6 and 7 in Section X of this Study. Water rights are explained in Section VI.

C. Theriot Spring

Natural springs along the west edge of the Park City Golf Course have been partially developed over the years into the existing water source commonly referred to as the Theriot Spring (Figure 8).

Spring development improvements were formally initiated in 1974 with installation of a manhole collection box and buried interceptor piping. A new pumphouse was constructed near the collection box. The pumphouse equipment included initially 3 three-stage, 40 horsepower pumps and a small chlorination facility.

In 1981, further improvements were made to the existing pumps. A fourth stage was added to each pump to increase the pumping capacity. Additional booster pumps are planned for the pumphouse. Care must be taken to ensure that reservoir capacities are adequate to store pumped water from the Theriot Spring source. Careful pumping is required to avoid possible depletion of the free-flowing spring source.

Recent chemical water quality analyses are included in this study (Figures 9 and 10, Section X), as well as previous similar reports on the spring water. Important bacteriological tests were recently performed and these results are included in Figure 11.

The Theriot Spring pumphouse source is presently considered a dependable fresh water source with a maximum flow rate of 2.67 cfs (1,200 gpm). This flow rate can vary. The Public Works Department does consider 900 gpm as an accurate year-round capacity.

Care should be taken to assure that the chlorination facility is adequate to disinfect flows up to 2.67 cfs (1,200 gpm). All improvements to this source, and all water sources in Park City, must be formally approved by the Utah State Department of Health, Bureau of Public Water Supply (see Appendix A-5).

D. Pacific Bridge Well

A fourth water source currently available to Park City is the deep well located across from the new Park City High School and immediately south of State Highway 248 (see Figure 12, Section X).

The Pacific Bridge Company originally had the well drilled in 1948, and pump tested it at 0.62 cfs (280 gpm). The results of the well driller's report are included in this study as Figure 13. In 1977, a formal well pump test developed a flow rate of 0.59 cfs (263 gpm) with 259 feet of drawdown. The test pump was set at a depth of about 300 feet. Figure 16 indicates the results of that test. Chemical analyses of the well water were performed in 1974 and 1980, and are included as Figures 14 and 15.

In May 1982, the Park City Public Works Department stated that the well produced only 20 gpm with total drawdown. A few months later, the casing pipe was cleaned out and the well produced over 200 gpm (Figure 17).

E. Spiro Tunnel Gravity Pipeline

During the early summer of 1981, construction operations commenced on a 12-inch transmission pipeline in the Spiro Tunnel west of the Park City Golf Course. This pipeline stretched about 13,600 feet, from a bulkhead/collection facility deep inside the tunnel, to an existing 12-inch pipeline about 250 feet east of the Silver King portal. The Park City Engineer's records estimate the gravity flow rate available from this new pipeline at about 3 cfs (1,347 gpm). A year-round source capacity of 1,200 gpm is considered realistic and is used in this Study. Flow measuring equipment and remote transmitting apparatus are planned for the downstream end of the pipeline so that actual gravity flow rates can be monitored.

Additional flows not conveyed in the 12-inch pipeline are planned to be measured and remotely monitored with a Parshall flume and electronic transmitting equipment from a point about 6,600 feet inside the tunnel. This extra water flowing in the tunnel has been estimated at between 3.5 and 6.5 cfs (1,570 to 2,917 gpm). Typically the peak flows occur during June and July. The tunnel water was observed to be less clear than that flowing in the Judge/Anchor Tunnel.

The water right for this pipeline source was formally approved by the State Engineer in August 1982. Section VI explains this recent ruling. This pipeline must be considered an interruptable source because of the nature of the water rights in the Spiro Tunnel.

In spite of the complications and additional costs encountered with this pipeline construction project, it continues to be a very attractive water source. Water conveyed through mining works have typically shown chemical contaminants of one sort or another, although not usually at dangerous levels. Excessive chemical contaminants discovered in water issuing into the Spiro Tunnel between the portal and the 13,600 foot station mandated that the expensive 12-inch gravity supply pipeline be installed. The alternative would have been a water treatment plant having excessive annual operation and maintenance costs. Chemical analyses of water flowing from the Spiro source are included in Figures 18 through 20 in Section X of this Study. A chemical analysis of water sampled at the Thaynes Shaft is shown in Figure 21.

V. DEVELOPED POTENTIAL SOURCES

- A. Spiro Tunnel Pipeline and Pumphouse
- B. Park Meadows Well
- C. Sullivan Spring
- D. Stahle Springs

V. DEVELOPED POTENTIAL SOURCES

Several existing water sources in Park City have been developed and/or improved (Figure 22), but have not yet become a part of the municipal water system. Table 18 summarizes the total potential supply sources. Water rights problems and procedures need to be resolved prior to their dependable operation. Each developed potential source is considered a viable alternative or addition to the existing supply sources and is discussed in this section. Specific recommendations for development are presented in Section IX.

A. Spiro Tunnel Pipeline and Pumphouse

The 12-inch pipeline within the Spiro Tunnel allows for gravity flow of about 3.0 cfs (1,347 gpm) from the tunnel source to the Theriot Springs pump station and valve box. Should the present litigation concerning the Spiro Tunnel water rights be resolved, the flow potential of this water source could be further improved by pumping.

A pump station capable of approximately 9 cfs (4,039 gpm) would be required to pump all of the gravity flow of the West End (No. 143) and Thaynes Drift water into the 12-inch pipeline. The combined Park City and Salt Lake City rights amount to 10 cfs during high flows (see Section VI). The addition of pumps in the Spiro Tunnel will also necessitate enlargement of the pumping capacity of the Theriot Springs Pump Station. Water from this station is pumped to the Thaynes Canyon and Boothill Reservoirs as needed. Since the tunnel is the property of a private mining company, attention should be given to operation and maintenance problems with this source. Additional support timbers may be needed in the future.

Preliminary approximations of pump sizes and piping will be noted and recommended in Section IX. Water sources contained within old mining tunnels are not usually worth the maintenance, access, and safety problems associated with them. This Spiro Tunnel water source is considered an exception due to the large amount of dependable water available from it. Chemical analyses of the water flowing from the Spiro Tunnel are included in Section X of this Study. A detailed study concerning the distribution of this pumped water is needed. If all the 9 cfs (4,039 gpm) of water were continually pumped to the Boothill Reservoir, it could be filled about 5.8 times per day. Obviously, additional reservoir storage is needed if Park City takes full advantage of the large flow rate the Spiro Tunnel potentially could provide.

Park City can look forward to this as a major source of water for its residents if all the water rights litigation and procedures are resolved and completed.

B. Park Meadows Well

Perhaps the most promising long term, low maintenance water source discovered in the Park City area is the Park Meadows Well (Figure 22, Section X). This deep well was drilled and improved in 1979 and yielded up to 3.34 cfs (1,500 gpm). The well penetrates a massive aquifer in the Thaynes Formation. The results of the Well Driller's report are included as Figure 23. Only 20 feet of water level drawdown for 1,500 gpm was shown during a well pump test taken in October, 1979.

The City is aware of the water rights litigation and general controversy concerning the Park Meadows Well. All water rights and agreements with it are discussed in Section VI of this Study.

This specific well is positive proof of easily accessible, high-quality drinking water on Park City owned property. Positive sources such as this are definitely preferred over high maintenance prone and potentially dangerous mining tunnel sources.

Water quality samples of the well water were taken and have shown the water to be free of chemical and bacteriological contamination. The results are shown in Figure 24 in Section X of this Study.

The well was drilled 300 feet deep and cased 130 feet deep with 10-inch diameter steel pipe. In September 1979, a five-stage 100 horsepower submersible well pump was set at a depth of 125 feet. A formal well pump test was performed. The results of the test are shown in Figure 25. The pumphouse building and interior piping were completed in late 1979. Since that time, due to water rights litigation, the facility has not been allowed to contribute to the municipal water system. The design of the pumphouse piping will allow installation of a booster pump to help convey 1,500 gpm to an elevated reservoir, most likely the Boothill Reservoir. A detailed computer analysis of water pumped from this well and the Spiro Tunnel source should be performed. The Theriot Springs and Pacific Bridge pump stations should also be included in the analysis. At this point in time, insufficient reservoir capacity exists in the water system to fully appreciate either of these potential sources.

The Park Meadows well is preferred over the Spiro Tunnel pump station as the major water source for Park City. The excellent source potential and low maintenance requirements definitely favor this facility. Its central location is also an attractive feature. Further analysis and conclusions and recommendations concerning the present Park Meadows well are contained in Sections VIII and IX, respectively.

C. Sullivan Spring

The largest spring in a series of three springs on the Snow Summit Ranch property west of Park City continues to be recognized as a potential new water source. Several concerns regarding these springs and their complete development make this alternative less desirable than the others previously mentioned. Major procedures that would need to be completed include: acquisition of water rights, health precautions for protection from surface contamination, compensation for productive lands not being irrigated, and negotiations with the Snow Summit Ranch landowners since large tracts of land near the springs are considered developable.

Water rights and agreements concerning this plentiful spring source are discussed in Section VI of this Study.

The Park City Engineer reported in 1972 that the following flows were available from the springs:

| | |
|-----------------|------------------------|
| Lower Spring | 32 gallons per minute |
| Carey Spring | 70 gallons per minute |
| Sullivan Spring | 592 gallons per minute |

The Sullivan Spring is definitely the most abundant and the preferred source. Chemical analyses were done on this spring water in 1971, but are inconclusive. New chemical and bacteriological samples should be taken if Park City becomes interested in developing the Sullivan Spring into a dependable fresh water source. Interestingly, several houses in Thaynes Canyon are presently using water from Sullivan Spring for domestic purposes with no adverse effects.

Presently, the Park City Golf Course is irrigating with water from these springs. Years ago, Greater Park City Company leased water rights and set up a separate irrigation system for the golf course. Since Park City Municipal Corporation now owns the golf course, it is understood that they also still legally lease the spring water for their irrigation purposes.

Until Park City obtains title to all available water rights at Sullivan Spring, it is recommended that this potential developed source not be further improved. However, ongoing negotiations for water rights purchases from Snow Summit Ranch should continue in the event Park City would need to fully develop the spring and use this convenient source in the future.

D. Stahle Springs

Along the northwestern limits of Park City, above Thaynes Canyon Subdivision No. 3, is a series of small springs known as the Stahle Springs. Approved irrigation season water rights for this source are owned by Park City. Flow measurements of the overflow pipe on the main collection box in May 1982, have shown the springs to yield about 75 gpm. The water appears to be of excellent quality, suitable for direct conveyance to indoor users. Presently, about four homes and related buildings north of Payday Drive are reported to be using this spring water for domestic purposes.

The springs have been developed to some extent, with C.M.P. collection boxes, piping and fencing. Additional improvements are needed if Park City chooses to take full advantage of this fresh water source. Another spring, uphill from the three developed springs, issues from the same hillside at a rate of about 10 gpm. This water is not presently being collected.

The Stahle Springs can be considered a small, but dependable, potential spring source for Park City. Approximately 85 gpm can be expected from the four springs. Flow measurement and monitoring programs should commence soon in order that a year-round flow rate can be identified. Chemical and bacteriological analyses should be performed to document their water quality status. Clay seals should be installed over the spring collection areas to protect them from possible surface contamination. All of these sources are on private property. It is recommended that Park City postpone major improvements to the Stahle Springs until additional year-round flow data is obtained.

VI. WATER RIGHTS AND AGREEMENTS

- A. Park City Water Rights Plates
- B. Term Definitions
- C. Status of Park City Water Rights
- D. Findings

PARK CITY WATER RIGHTS

| (1) Item No. | (2) Source, Owner and Area Code No. | (3) Type of Right and No. | (4) Priority Date | (5) Flow Rate (cfs) | (6) Annual Volume (ac-ft) |
|--------------------|--|--|-----------------------------------|------------------------------|------------------------------------|
| 1. | Judge/Anchor Tunnel Park City Municipal Corp. (PCMC) 35-3340 | Change Application a-7845 Underground Water Claim (UGW) 15407 | 1936 | 1.378 (-0.334)* 1.044 | 995.9 (241.4) 754.5 |
| 2. | Kimball Creek PCMC | Exchange Application (Exch.) 1039 | #27611** 1950 #1039 1976 | 0.04 | 30.00 |
| 3. | Pacific Bridge Theriot Spring Alliance/Judge Tunnel PCMC | Exch. 1218 | #27611 1950 #1218 1979 | 0.42 | 300.00 |
| 4. | Pacific Bridge Well PCMC | Exch. 598 | WRD*** 1896 #598 1973 | 0.34 | 247.5 |
| 5. | Sullivan Spring PCMC | WRD No. 477 | 1894 | 0.07 | 12.3 |
| 6. | Stahle Spring PCMC 35-1743 | WRD No. 458 Diligence Claim (D.C.) | 1882 | Low 0.50 High 1.60 | 120.00 |

* As long as United Park City Mines Company does not need their 0.334 cfs (150 gpm), Park City can use it.

** No. 27611 is the application to appropriate number given to the U. S. Bureau of Reclamation for their stored water in East Canyon Reservoir. This is the basis of Exchanges 1039 and 1218.

*** The Davis and Weber Counties Canal Company was awarded WRD's No. 44, 48, 58, 68, 90, 389, 400, and 406. This is the basis of Exchange 598.

NOTE: It is not always possible to compute the annual volume of each right by extending the flow rate over 365 days per year as some rights were originally established as irrigation rights for a specific number of acres or for a set period of use.

PARK CITY WATER RIGHTS



PLATE

1

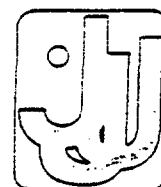
PARK CITY WATER RIGHTS

| (1) Item No. | (2) Source, Owner and Area Code No. | (3) Type of Right and No. | (4) Priority Date | (5) Flow Rate (cfs) | (6) Annual Volume (ac-ft) |
|---|--|--|---------------------------------|------------------------------|------------------------------------|
| 7. | Theriot Spring and Sullivan Spring United Park City Mines Company | WRD No. 456 and 463 | 1880 | Low 0.82 High 2.62 | 196.8 |
| 8. | Theriot Spring PCMC 35-93 | WRD No. 491 Application No. 11036, Cert. 4015 | 1931 | 1.50 | 540.5 |
| 9. | Park Meadows Well**** | Exch. 1577 | #27611 1950 #1577 1979 | 0.46 | 330.00 |
| 10. | Spiro Tunnel**** PCMC & Greater Park City Company 35-2708 | Change Application No. a-11857 | 1917 | Low 2.66 High 4.00 | 1922.4 2890.8 |
| 11. | Spiro Tunnel Salt Lake City Corp. | Change Application No. a-11817 | 1917 | Low 3.99 High 6.00 | 2883.6 4336.2 |
| 12. | Alliance Tunnel**** Judge/Anchor Tunnel PCMC 35-4704 | Change Application No. a-7899 U.G.W.C. No. 22649 | 1974 | 2.00 | 1445.4 |
| TOTAL Approved Water Rights (Low Flow) | | | | 3.344 | 2201.6 |

**** These water rights are pending State Engineer's approval.

NOTE: It is not always possible to compute the annual volume of each right by extending the flow rate over 365 days per year as some rights were originally established as irrigation rights for a specific number of acres or for a set period of use.

PARK CITY WATER RIGHTS



PLATE

2

VI. WATER RIGHTS AND AGREEMENTS

B. Term Definitions

The following term definitions explain the column headings used on the preceding Park City Water Rights Plates 1 and 2:

- 1) Column No. 1 "Item No.": A numerical listing of the water rights.
- 2) Column No. 2 "Source, Owner and Area Code No.": The "source" is the name of the particular source to which the water right is tied. The "owner" of the source is shown as it has been recorded with the State Engineer's Office. The "area code number" refers to the State Engineer's numbering system. Park City is in Area 35. These numbers are required to find the right in the State Engineer's filing system.
- 3) Column No. 3 "Type of Right and Number": Park City's water rights have been established by five different methods:
 - a) Weber River Decree (WRD): The Decree was based upon the Court Hearing No. 7487, Findings of Fact, Conclusions of Law and Judgment and Decree, which was the settlement of a law suit entitled "Plain City Irrigation Company versus Hooper Irrigation Company and North Ogden Irrigation Company." The Decree covered the entire Weber River drainage and took into account all surface water sources,

including springs, and surface streams. Each water right was assigned a decree number, an owner of record, a flow rate, a total annual volume, a place and nature of use, and a period of use.

- b) Underground Water Claim: Prior to 1935 any individual or entity may go into an area, such as a mining district, and claim the water developed from an underground source. That has been the basis of several of Park City's existing water rights. The claim, once filed in accordance with Utah Code Annotated 1953, Section 73-5-13, establishes prima facie evidence of the water right.

- c) Change Application: An individual or entity may want to take an existing water right, such as a decreed right or an underground water claim, and make a change in its point of diversion, the place and nature of use. The change application must be properly filed with the Utah Division of Water Rights. It must then be advertised for a minimum of 30 days in the local newspapers. Following the advertisement period, local water rights holders are given another 30 days in which to protest the change. If protests are received, the State Engineer generally holds a public hearing to evaluate both sides of the case. Based on supporting information, the State Engineer must then make a ruling to approve or disapprove the change. If approved, the Change Application becomes a vested water right.

- d) Exchange Application: This application is done primarily on rights that are based in storage in reservoirs. An example is East Canyon Reservoir, where the water rights are held by either the Weber Basin Water Conservancy District or the Davis and Weber Counties Canal Company. Exchanges accomplish much the same purpose as Change Applications. They can change the point of diversion and place of use if consistent with the underlying water right. Deficits to downstream users can be made up by releasing reservoir water. The approval process is handled in the same manner as for Change Applications.
- e) Diligence Claim: An applicant may file on the water he has been using prior to 1903 in order to establish a legitimate water right. The claim, once filed in statutory form, constitutes prima facie evidence of the water right.
- 4) Column 4 "Priority Date": The "priority date" is the date on which the right was established. Water rights with early priority dates must be satisfied in full before rights with later priority dates can be satisfied. This is especially critical during low flow or drought periods. The date of priority is not lost by changing the nature of use, point of diversion, or place of use. Domestic users are given a statutory preference in the case of water rights of equal priority.
- 5) Column 5 "Flow Rate": This column indicates the flow rate of the water in cubic feet per second (cfs). One cfs is equal to 448.8 gallons per minute (gpm).

- 6) Column 6 "Annual Volume of Right": This column indicates the water right's volume of water per year in acre-feet. An acre-foot is the volume of water it takes to cover an acre of land with water one foot deep.

C. Status of Park City Water Rights

Exhibit 3 indicates the location of water rights listed in the Park City Water Rights plates. Figure 1 illustrates the diversion allowances available from Park City controlled water rights during the water year. A discussion of the status of these water rights follows:

1) Judge Anchor Tunnel - Change Application a-7845

This is an excellent water right. It was used as collateral for a Utah Board of Water Resources loan to improve the Judge Tunnel. This loan was recently paid off by Park City. The title has been formally returned to Park City by the Board.

A Change Application was made on the original Underground Water Claim No. 15407. The Underground Water Claim was obtained through an agreement with United Park City Mines Company, the original owner.

United Park City Mines has, however, reserved 0.334 cfs (150 gpm) of the right for mining purposes should the mines start up again and require this water. As long as the mines are not using the water, it is available for municipal use.

2) Kimball Creek - Exchange Application No. 1039

Exchange Application 1039 is being modified by Exchange Application 1577 in conjunction with the Park Meadows Well right and the Pacific Bridge Well (Exchange Application 1218). Exchange 1577 seeks to combine Exchange Applications number 1039 and 1218. It is highly recommended that Park City amend Exchange Application No. 1577 to include the same points of diversion as Exchange Applications No. 1039 and 1218, as well as the Park Meadows Well. This would enable the City to withdraw water from any of these sources. Exchange Application No. 1577 is presently pending the State Engineer's approval.

Exchange Application No. 1039 is approved and can continue to be used as long as Application No. 1577 is pending approval. Once Exchange Application 1577 is approved, this Exchange Application will be withdrawn.

3) Pacific Bridge Well - Exchange Application No. 1218

Exchange Application 1218 is being modified by Exchange Application 1577 in conjunction with the Park Meadows Well right and Kimball Creek (Exchange Application 1039). Exchange 1577 seeks to combine Exchange Applications number 1039 and 1218. It is highly recommended that Park City amend Exchange Application No. 1577 to include the same points of diversion as Exchange Applications No. 1039 and 1218, as well as the Park Meadows Well. This would enable the City to withdraw water from any of these sources. Exchange Application No. 1577 is presently pending the State Engineer's approval.

Exchange Application No. 1218 is approved and can continue to be used as long as Application No. 1577 is pending approval. Once Exchange Application 1577 is approved, this Exchange Application will be withdrawn.

4) Pacific Bridge Well - Exchange Application No. 598

This is a good water right in fully approved status. However, since the 1982 cleaning of the Pacific Bridge Well to yield 210 gpm, it appears that the well could produce up to 338 acre-feet per year or 38 acre-feet more than the 300 acre-foot entitlement. Therefore, an additional 38 acre-foot right could be added to the Pacific Bridge Well.

5) Sullivan Spring - Weber River Decree No. 477

This is a fully approved right which was originally set up to irrigate the City's cemetery. This right should have a Change Application filed on it to add additional points of diversion as well as place and nature of use. This would allow the City to pull water from other sources such as the Theriot Spring. The City also has the right to use additional flow from Sullivan Spring to irrigate the Park City Golf Course. However, these irrigation rights are still owned by the Armstrongs.

6) Stahle Springs - Weber River Decree No. 458

This right is presently tied to a point of diversion, being a spring located in the Northwest Quarter of the

Northwest Quarter of Section 8, Township 2 South, Range 4 East, Salt Lake Base and Meridian. As this is an approved right, a Change Application should be completed to add additional points of diversion and to change the nature of use to municipal.

7) Theriot Spring - Weber River Decrees No. 456 and 463

These water rights were originally decreed to Silver King Consolidated Mining Company in 1880. In 1953, Silver King Consolidated deeded WRD's No. 456 and 463 to United Park City Mines Company (UPCMC). In 1974, UPCMCMC agreed to give WRD's No. 456 and 463 to Park City Municipal Corporation, but the deed was never completed. The City should ultimately take the necessary steps to effect the title transfer of these two rights. WRD No. 463 is tied to Sullivan Spring and is good for the irrigation of 5.6 acres. A Change Application modifying the nature of use should be filed.

8) Theriot Spring - Weber River Decree No. 491

This is also a good water right. It has been established for use during the non-irrigation season (winter months) only. It will be best to leave this right as it is. Weber River Decree No. 456 compliments this right and allows for year-round use of the Theriot Springs.

9) Park Meadows Well - Exchange Application No. 1577

This Exchange is explained in paragraphs No. 2 and 3 above.

10) Spiro Tunnel - Change Application No. a-11857

This Change Application is presently pending State Engineer's approval. Upon approval, this change will give the City the right to 40 percent of the Spiro flow beyond the 6,600 foot station in the Tunnel.

11) Spiro Tunnel - Change Application No. a-11817

The water right involved in this Change Application is held by the Salt Lake City Corporation. The Change Application was approved by the State Engineer in August 1982. However, the Weber Basin Water Conservancy District appealed this approval in September 1982, and the right is in litigation awaiting Court hearing. This appeal does not prohibit Park City's current use of Salt Lake City's 60 percent share of the Spiro water. Park City has made a formal agreement, dated January 29, 1980, to become a water customer of Salt Lake City Corporation and purchase surplus water from its share in the Spiro Tunnel. The agreement requires Park City to pay Salt Lake City Corporation its prevailing water rate when it uses any portion of Salt Lake City's water right in the Spiro source. However, this agreement allows Salt Lake City Corporation to recall and use this water if a need is demonstrated. Once this Change Application and the preceding one (a-11857) are approved, Park City will have about 6.65 to 10 cfs additional water and water rights available to lease or own.

12) Alliance and Judge/Anchor Tunnels - Change Application a-7899

This water right was formerly established by Underground Water Claim No. 22649 covering the Alliance Tunnel only. In 1974, Change Application No. a-7899 was filed to include the Judge/Anchor Tunnel as well. While it has been through all of the State Engineer's required hearings and processes, the right is still pending his formal approval. Since it is in the same category as the approved Judge/Anchor Tunnel right (Change Application No. a-7845), there is a chance that the State Engineer may still approve Application a-7899. The City should press for a decision. It is recommended that Park City amend the Change Application and add additional points of diversion to better protect the right in case of mine failure. The right is for 2 cfs, a total of 1445.4 acre-feet per year. This could be a very valuable asset to the City in years to come.

Even though both the Change Application and the Underground Water Claim were filed in the name of Park City Municipal Corporation, UPCMC has never released title to Park City. An agreement should be entered into between Park City and UPCMC giving title to the Judge and Alliance water involved in Application a-7899 to Park City Municipal Corporation.

D. Findings

The Park City Water Rights plates 1 and 2 indicate that Park City does have a total of 2,202 acre-feet of approved water

rights. Some of these rights should be amended to enable Park City to draw water to the full extent of its rights from any of its approved sources.

The Change Applications on the Spiro Tunnel make the geologic contention that water in the tunnel beyond the 6,600 foot station is either tributary to Big Cottonwood Canyon (Salt Lake City's contention) or new water tributary only to the deep geologic strata of the earth (Park City's contention). The rights may ultimately be approved through the Court and the State Engineer, but it may take up to three years. In the event the lawsuit fails, the State Engineer could approve these applications if Park City had a physical means of providing replacement water. Alternative methods of making such replacement are discussed in Section VII.

In the event the Spiro Change Applications are ultimately approved, Park City should make every effort to purchase equivalent water rights and trade Salt Lake City for ownership of its share of the Spiro flow. Salt Lake City Corporation has indicated an interest in making such a water rights trade with Park City. A favored alternative is to run water through the existing Weber Basin Water Conservancy District transmission system to North Salt Lake using Davis and Weber Counties Canal water rights. Keith Jensen, District Manager of Weber Basin Water Conservancy District, has indicated this alternative is possible. A study would need to be made to determine available capacity in this conveyance system. Pump stations may have to be added along the line to boost the capacity.

The Metropolitan Water District in Salt Lake City indicated that water could be delivered to Salt Lake City via Deer Creek and the Deer Creek Aqueduct to Little Cottonwood Canyon. Rights from this source would come from either an agreement with the Beaver Shingle Creek Irrigation Company with respect to shares

of Deer Creek Reservoir water, or from Smith-Moorehouse Reservoir, as described in alternative No. 5. Agreements must be made between Park City and Salt Lake City to perfect a graduated trade of water rights between the two cities. Trade options are discussed in Section VIII.

The Park Meadows Well Exchange No. 1577 will only be approved if the City has replacement capabilities. This well could annually produce in excess of 2,400 acre-feet. Park City should buy additional rights for this source. This will enable the City to realize the full potential of the Park Meadows Well.

The replacement problem exists only during the irrigation season on property between Park City and the East Canyon and the (planned) Silver Creek Sewage Treatment Plants as this alternative may be impacting decreed irrigation rights. For this reason, it is necessary to make replacement only during the irrigation season. This would facilitate lower operation and maintenance costs for replacement facilities and less water rights purchase costs.

VII. NEW ALTERNATIVE SUPPLY SOURCES

- A. Satellite Wastewater Treatment Plants (Alternative No. 1)
- B. Recycle SBSID Wasterwater Effluent (Alternative No. 2)
- C. East Canyon Springs Pipeline (Alternative No. 3)
- D. East Canyon Creek Pipeline (Alternative No. 4)
- E. Smith-Morehouse Water Exchange (Alternative No. 5)
- F. Smith-Morehouse Transmission Pipeline (Alternative No. 6)
- G. Weber River/Oakley Transmission Pipeline (Alternative No. 7)
- H. Park Meadows Well No. 2 (Alternative No. 8)
- I. Mandatory Water Saving Devices

to the existing East Canyon Wastewater Treatment Plant and the planned Silver Creek (Atkinson Spring) Wastewater Treatment Plant. It is estimated that only 2 to 5 percent of all indoor water used is actually consumed. Hence, these remote satellite plants could treat and replace to the stream up to 98 percent of the indoor water delivered.

B. Recycle SBSID Wastewater Effluent (Alternative No. 2)

This alternative proposes that the presently treated effluent from the existing East Canyon Wastewater Treatment facility be diluted with creek water and pumped out of the creek downstream of the facility up to Park City via a pressure transmission pipeline. The potential for a similar pumping and transmission pipeline exists with the planned Silver Creek (Atkinson Spring) Wastewater Treatment Plant. This water would be used as irrigation replacement water and would be released into existing water courses in the Park City area. A fresh drinking water source would need to be used in conjunction with this replacement water source. Exhibit 5 illustrates the possible alignments of the two transmission line and pumping facilities.

C. East Canyon Springs Pipeline (Alternative No. 3)

The East Canyon Springs alternative would utilize three potential sources of water:

- 1) A large spring in the Dry Hollow/Schuster Creek area of East Canyon, estimated to be capable of producing about 1.5 to 2 cfs (675 - 900 gpm);

- 2) Several potential wellsites in aquifers in the Big Bear and Dry Hollow areas which display a potential to produce approximately 4.0 cfs (1,800 gpm);
- 3) Most of the treated water processed by the East Canyon SBSID Wastewater Plant that was originally generated by Park City sewer connections; and

The yields from both the existing spring and the potential wellsites would be pumped up to a 20,000 gallon holding tank. A water treatment facility ideally could be located east of the Interstate 80/Gorgosa interchange. Land acquisition procedures may dictate a facility further south towards the SBSID wastewater treatment plant. The water treatment plant is planned to have the capacity to treat an amount of water taken from East Canyon Creek equivalent to the average wastewater flows contributed to the SBSID plant by Park City. Once the treatment process is complete, waters from the spring, wells, and the plant would be combined and pumped up to Park City. If the wells and spring do not provide enough water, more water could possibly be supplied with additional water treatment plant capacity.

Local landowners have expressed interest in this type of domestic water use alternative. Additionally, water from developed well sources in the Kimball's Junction area could be designed to contribute to the East Canyon pipeline. Exhibit 6 indicates the alignment of this pipeline alternative.

D. East Canyon Creek Pipeline (Alternative No. 4)

Immediately downstream of the existing East Canyon Wastewater Treatment facility a diversion works, pump station and water treatment plant could be constructed (Exhibit 7). From there a high pressure pipeline could be built south to Park City. This pipeline would require approximately 65% of the pressure pipeline needed for the preceding alternative. However, both alternatives involve acquiring water rights, securing necessary easements and rights-of-way, protecting the water rights of downstream users, and obtaining required governmental approvals. Additionally, stream hydrology analyses need to be performed. If it were determined that additional flow from East Canyon Creek was available due to increased Park City generated effluent from the sewage plant, even more water could be pumped from the creek up to Park City without purchasing additional water rights.

E. Smith-Morehouse Water Exchange (Alternative No. 5)

The Utah Division of Water Resources and the Weber Basin Water Conservancy District are planning a 7,000 acre-foot enlargement of the existing Smith-Morehouse Reservoir east of Park City (Exhibit 8). The new reservoir would impound a total of 7,900 acre-feet, 900 acre-feet of which will be maintained as a conservation pool for fisheries. This increased reservoir capacity could provide an indirect new source of drinking water or irrigation replacement water for Park City if an exchange plan were formulated and improvements completed.

This alternative concerns the exchange of waters by diverting additional water from the Weber River to the Provo River via the existing Weber-Provo Diversion Canal. The same amount of water

that is transferred to the Provo River would be intercepted in the existing Ontario Shaft No. 3 and pumped to the upper reaches of Park City via Ontario Drain Tunnel No. 1 (Exhibit 8). Mining tunnels presently collect water from the many mining drifts and stopes in the mountains southwest of Park City and convey it east to Ontario Shaft No. 2 and through Ontario Drain Tunnel No. 2 into Drain Tunnel Creek and the Provo River.

F. Smith-Morehouse Transmission Pipeline (Alternative No. 6)

A gravity pipeline could be installed from the Smith-Morehouse Reservoir west to Park City (Exhibit 9). Approximately 9.7 cfs (4,340 gpm) of lake water would be fully treated and piped by gravity to Park City. This fresh water transmission pipeline could be allowed to supply municipal connections in all of the Kamas Valley and Brown's Canyon area.

G. Weber River/Oakley Transmission Pipeline (Alternative No. 7)

If the gravity pipeline from the Smith-Morehouse Reservoir to the Oakley area were not required, only a pump station and water treatment plant on the Weber River near Oakley and a pressure transmission pipeline to Park City would be needed (see Exhibit 10). The water for this alternative would be impounded in the proposed enlarged Smith-Morehouse Reservoir and conveyed down to the pump station at Oakley via the Weber River. A diversion works and pond would be built near the river east of Oakley where the pumphouse and treatment plant could be located.

This alternative pipeline plan should only be considered feasible when based on new available Smith-Morehouse water, not speculative well drilling in the Kamas Valley area.

H. Park Meadows Well No. 2 (Alternative No. 8)

Exhibit 11 identifies the proposed location of Park Meadows Well No. 2. In 1979, the original Park Meadows Well was drilled and tested (Section V). As a new alternative water source, a second, larger diameter well could be drilled near the same location and used as the major domestic water supply source for Park City. The results of the well pump test of the original Park Meadows Well (Figure 25) substantiate the massive potential of the aquifer contained in the Thaynes Formation. If a second well were to be drilled into this aquifer and a larger pump installed, a considerable amount of high quality drinking water might prove instantly available to Park City. The use of either well would require replacement water to downstream users during the irrigation season.

I. Mandatory Water Saving Devices

Conservation of water is one of the first steps Park City must take to avoid waste and misuse of valuable water resources. The American Water Works Association (AWWA) and other water related agencies have conducted extensive research on the subject of water conservation. An excellent publication by the AWWA is cited in the List of References, Appendix A-7. Tables 23, 24 and 25 identify water savings available from the use of indoor and outdoor water savings devices. Park City Municipal Corporation could mandate the use of certain water saving fixtures as a condition in granting building permits and/or approving new construction in the Park City area.

It is recommended that Park City Municipal Corporation implement water conservation practices as a necessary part of its water supply program. Water conservation and water-saving devices

should be required in all communities with municipal water systems. Figure 34 in Section X illustrates the water savings when conservation measures are implemented. Indoor water use and hot water use for typical residences are shown in Figures 35 and 36, respectively.

VIII. ANALYSIS OF ALTERNATIVES

- A. Satellite Wastewater Treatment Plants (Alternative No. 1)
- B. Recycle SBSID Wastewater Effluent (Alternative No. 2)
- C. East Canyon Springs Pipeline (Alternative No. 3)
- D. East Canyon Creek Pipeline (Alternative No. 4)
- E. Smith-Morehouse Water Exchange (Alternative No. 5)
- F. Smith-Morehouse Transmission Pipeline (Alternative No. 6)
- G. Weber River/Oakley Transmission Pipeline (Alternative No. 7)
- H. Park Meadows Well No. 2 (Alternative No. 8)

VIII. ANALYSIS OF ALTERNATIVES

The comprehensive analysis of each alternative involves the evaluation of six major considerations identified as the most important with regard to long-term benefit, feasibility and cost. Minor concerns will also be noted. The six considerations are:

1) Physical Water

Water requirements and available water supplies are discussed. Deficits in source capacity are identified. A synopsis of previous sections in this Study indicates the following:

The Study Area

| <u>Year</u> | <u>Source Capacity Required(1)</u> | <u>Existing Source Capacity(2)</u> | <u>Source Capacity Surplus/(Deficit)</u> |
|-------------|--|--|--|
| 1982 | 2291 gpm | 3510 gpm | 1219 gpm |
| 1985 | 2842 | 3510 | 668 |
| 1990 | 4258 | 3510 | (748) |
| 1995 | 5592 | 3510 | (2082) |
| 2000 | 6907 | 3510 | (3397) |
| 2010 | 8040 | 3510 | (4530) |
| 2020 | 8938 | 3510 | (5428) |

(1) Table 17, Total Flow Requirement

(2) Table 18, Section A, Subtotal A

The quantity of water from the existing supply sources will be compared to the source capacity required for Park City. Conclusions will be drawn after relating the benefits available from each alternative to the source capacity and water right requirements for Park City.

2) Water Rights

Table 19, sheet 2, indicates the forecast water rights situation for the Study Area up to the year 2020. The projected surplus/deficit in approved water rights is listed below.

The Study Area

| <u>Year</u> | <u>Source Capacity Required(1) (gpm)</u> | <u>Rights Required(2) (acre-feet)</u> | <u>Approved Rights(3) (acre-feet)</u> | <u>Rights Surplus/ (Deficit)(4) (acre-feet)</u> |
|-------------|--|---|---|---|
| 1982 | 2291 | 1674 | 2202 | 528 |
| 1985 | 2842 | 2075 | 2202 | 127 |
| 1990 | 4258 | 3100 | 2202 | (898) |
| 1995 | 5592 | 4068 | 2202 | (1866) |
| 2000 | 6907 | 5020 | 2202 | (2818) |
| 2010 | 8040 | 5842 | 2202 | (3640) |
| 2020 | 8938 | 6497 | 2202 | (4295) |

(1) Line 1, Table 19, Sheet 2

(2) Line 7, Table 19, Sheet 2

(3) Line 8, Table 19, Sheet 2

(4) Line 9, Table 19, Sheet 2

The procedures required to secure the necessary water rights for each alternative will be explained. Feasibility of securing the needed water rights for each alternative will be presented.

3) Land Acquisition

Each alternative is located on property that is presently owned by Park City, private citizens, or the State or Federal government. Much of the real estate involved in the alternatives is County and/or State controlled rights-of-way. Necessary easement procedures will be identified. Recommended locations of treatment facilities and pipeline alignments are shown on the exhibits in Section X. Approximate costs are included in Figures 26 through 33.

4) Cost to Benefit Ratio

Each alternative provides a different flow rate potential and requires construction costs unique to that alternative. A cost to benefit ratio was calculated so that all the alternatives could be compared on an equivalent basis. The cost to benefit ratio is the ratio of the alternative's total annual cost to its flow rate potential.

The total annual costs include three capital expenditures anticipated with each alternative:

- a) Cost to purchase/lease water rights;
- b) Payment on construction loan and land costs;
- c) Operation and maintenance costs.

The costs were computed assuming an 11 percent annual interest rate and amortized from the predicted first year of construction to 15 years. Yearly payments were assumed. A total annual payment was then computed. The cost/benefit ratio for each alternative is the annual payment in 1982 dollars divided by anticipated flow rate potential in gallons per minute (gpm). Table 26 lists each of the eight alternatives and their respective annual costs and cost/benefit ratio.

5) Governmental Approvals

The most unpredictable factors in developing water supply projects are the owner's requirements and obligations associated with review and approval processes by governmental agencies. All of the alternatives will experience approval work that could set back initial construction activity from one to ten years. Because of this, Park City must not anticipate having actual use of an improved water supply project without first considering all possible delays and unforeseen requirements arising during the governmental approval phase.

State agencies requiring formal review and approval include the Utah State Engineer, the State of Utah Departments of Health and Transportation, and the Utah State Divisions of Water Rights, Water Resources, Wildlife Resources, State Lands and Forestry, and Parks and Recreation.

Federal agencies, such as the Department of Agriculture (Soil Conservation Service), the Environmental Protection Agency, and the Geological Survey (USGS), should also be expected to require review and approval.

Utility coordination and service agreement procedures between Utah Power and Light Company, Mountain Fuel Supply Company, and Mountain Bell must be planned for as well.

Agreements with water districts in both the Weber River and Provo River drainages must be investigated and secured if necessary.

The time and money anticipated for these approvals, agreements, and negotiations will be outlined and discussed for each alternative. Costs forecast for this work are included in the cost to benefit ratio.

6) Timing

Each alternative proposed will require a different lead time. A project's timing is the summation of chronological phases that include: feasibility analysis, a final decision, engineering design, governmental approval, construction, and final project start-up. Financial arrangements are assumed to be available.

Brief discussions of the timing for separate phases will be included in each analysis. Certain factors affecting the overall schedule of an alternative may make it less feasible as a short-term (10 year) solution to Park City's water problem. The recommended alternative(s) will demonstrate acceptable costs, a favorable timing schedule, and an attractive completion date.

A. Satellite Wastewater Treatment Plants (Alternative No. 1)

Satellite wastewater treatment plants could provide irrigation replacement water by releasing downstream treated wastewaters originating from Park City. This alternative requires:

- 1) One 1.5 million gallon per day (MGD) (2.3 cfs) activated sludge treatment plant located in the Quarry Mountain area, preferably in the northwest part of the Quarry Mountain sub-area.
- 2) One 2.5 MGD (3.9 cfs) aerated lagoon wastewater treatment system located in proximity to the existing sanitary landfill east of Park City.

The primary purpose of this alternative is the replacement of water to both the East Canyon Creek and the Silver Creek. This replacement would allow year-round municipal use of a finite amount of water from locally developed sources.

1) Physical Water

Park City would be allowed to release downstream an amount of water approximately equal to the average amount of treated sewage originally generated during the irrigation season by Park City sewer connections (Table 22). By the year 2000, this is forecast to be about 2.9 cfs (1,290 gpm) during the irrigation season. Tables 20 and 21 tabulate forecasts for sewerage flows during the ski season.

The average released treated wastewater flows available from these satellite plants cannot match the irrigation replacement water necessary to use locally developed

municipal water sources in the amount eventually needed in the Study Area. Another independent municipal source and/or other replacement sources would need to be realized if all year-round water requirements are to be met with this alternative.

2) Water Rights

Additional water rights would not be required for this alternative since it merely treats and releases water previously circulated in the system. Furthermore, in considering return flow credits, the water right requirement of the overall water system may be reduced upon negotiation with the State Engineer and the State Department of Health. In treating and releasing used water, surface and sub-surface flows that may be captured by pumping or draining are automatically compensated for by the treated wastewater release.

3) Land Acquisition

The proposed location of the Silver Creek satellite aerated lagoon system has been reviewed and accepted by local developers of the Richardson Flat area (sub-area No. 9). A preliminary site has been agreed upon for the construction of such a wastewater treatment facility (Exhibit 4).

The proposed location of the East Canyon satellite treatment plant has been reviewed by local landowners. However, no decision has been made concerning the aesthetics of constructing such a plant in the northwest Quarry Mountain area.

Costs for land acquisition and access easements are anticipated to be \$20,000 per plant. With the Silver Creek facility, the majority of the sewer line could be contained in established State road rights-of-way. The lagoon would be sited on private property to be donated to the City. The East Canyon facility would need about 300 feet of sewer line to connect into the existing trunkline. It would be sited on approximately 2 acres of private property.

4) Cost to Benefit Ratio

Annual Costs

| | | | |
|-----------------------|---------------|----------------|-------------------------------------|
| Lease water rights: | \$ | 0 | |
| Construction loan | | | |
| payment: | | 1,815,775 | (Total project cost = \$13,057,000) |
| Operation and | | | |
| maintenance: | | <u>130,000</u> | (Includes labor, overhead etc.) |
| Total annual cost | \$1,945,775 | | |
| Flow rate potential | = 1,290 gpm | | |
| Cost to benefit ratio | = \$1,508/gpm | | |

Refer to Figure 26 for an itemized Opinion of Probable Costs.

5) Governmental Approvals

Approval by SBSID and the State Department of Health is not anticipated as present policy favors the consolidation of wastewater treatment facilities. Right-of-way permits for pipeline construction could be granted as early as Winter 1983.

6) Timing

Winter 1982 Preliminary studies and final decision made.
Autumn 1983: Final design completed.
 Indefinite approval period.

The satellite wastewater treatment plants alternative is not recommended because of the high cost to benefit ratio and the difficulty in obtaining governmental approvals. The long-term value of this alternative is questionable due to the insufficient amount of replacement water available from the two plants.

B. Recycle SBSID Wastewater Effluent (Alternative No. 2)

This alternative would provide for two irrigation ditch replacement sources using dilute treated wastewaters transmitted from the creeks downstream of the existing East Canyon Wastewater Treatment Plant and the proposed Silver Creek (Atkinson Spring) Wastewater Treatment Plant. Each would require a pumping system and pressure transmission lines to convey the dilute treated waters up to Park City from their respective treatment facilities. The discharge points at the upstream end of each transmission line would be located near the northern limits of Park City in the East Canyon and Silver Creek drainages (Exhibit 5).

The purpose of this alternative is the replacement of water to both the East Canyon Creek and Silver Creek tributaries of the Weber River drainage. This replacement would allow irrigation season use of a finite amount of water from locally developed sources.

1) Physical Water

Park City would be allowed to release an amount of water approximately equal to the average amount of treated sewerage originally generated by Park City sewer connections (Table 22). By year 2000, this is forecast to be about 2.9 cfs (1,290 gpm) during the irrigation season. Each pipeline would be sized to convey a minimum of 860 gpm.

The necessary replacement water for the locally developed sources providing Park City's source capacity requirements cannot be totally met by this alternative. The amount of water available from the wastewater treatment plants depends

upon the number of contributing sewer connections. These pipelines might help satisfy short-term replacement water needs, but alone would be insufficient by the year 1992.

Adequate water is not available from this alternative since only average irrigation season sewerage flows can be pumped upstream as replacement water.

2) Water Rights

No additional water rights are required for this dual return pipeline plan since it merely recirculates water previously used in the system. Furthermore, when considering return flow credits, the water rights requirement of the overall water system may be reduced upon negotiation with the State Engineer and the State Department of Health.

This alternative, together with locally developed water sources, could supply a small portion of the water needed to service the Study Area. The fact that this solution would not require new water rights makes it attractive.

3) Land Acquisition

The proposed alignment of the recycled effluent transmission lines is within Utah State and Interstate rights-of-way. Since no private lands are expected to be used for this alternative, the costs associated with land acquisition pertain solely to the engineering and governmental approval process for right-of-way access and construction permits.

4) Cost to Benefit Ratio

Annual Costs

Lease water rights: \$ 0

Construction loan

payment: 184,818 (Total project cost =
\$1,329,000)

Operation and

maintenance: 31,000 (Includes pumping costs, .
labor, overhead etc.)

Total annual cost \$215,818

Flow rate potential = 1,290 gpm

Cost to benefit ratio = \$167/gpm

Refer to Figure 27 for an itemized Opinion of Probable Costs.

5) Governmental Approvals

All governmental approvals are anticipated to be obtained by Winter of 1985. Construction may then commence by Spring of 1986.

6) Timing

Winter 1984: Preliminary studies and final decision made.

Autumn 1985: Final design completed.

Winter 1985: Governmental approvals secured.

Spring 1986: Construction begins.

Summer 1987: Project completion.

Autumn 1987: Replacement water available.

The recycled SBSID wastewater effluent alternative offers an optimistic cost to benefit ratio and an uncomplicated governmental approval process. However, the water replacement advantage that could be obtained is not sufficient for long-term water requirements and, therefore, would not justify the installation of the transmission line systems.

C. East Canyon Springs Pipeline (Alternative No. 3)

The East Canyon Springs pipeline is scheduled to be constructed in three phases. Three water sources would ultimately be used to satisfy part of Park City's total water requirement. These sources are:

- 1) The Schuster Spring in East Canyon with an anticipated average flow rate of 1.5 to 2 cfs (675 to 900 gpm);
- 2) Well development in fractured bedrock aquifers in the Big Bear Hollow and Dry Hollow areas of East Canyon with an approximate flow capacity of 4.0 cfs (1,800 gpm); and
- 3) East Canyon Creek Water Treatment Plant capable of treating 3.1 cfs (1,390 gpm) of stream water.

A transmission line and pumping system would be constructed to connect the Schuster Spring, East Canyon Wells and the East Canyon Treatment Plant. The pipeline would then continue south along Utah Highway U-224 to Park City's existing water distribution system.

Phase I would include the entire pipeline from Schuster Spring to Park City, but would only use source "1" above. Phase II would utilize source "2" above, and Phase III would involve source "3".

1) Physical Water

The maximum anticipated yield from the Schuster Spring, Big Bear and Dry Hollow well sites, and the East Canyon Water Treatment Plant is taken as 9.1 cfs (4,090 gpm).

An important feature of this alternative is the desire of local developers to join Park City in a cost-sharing program for the water collection and distribution system. Ultimately, all water sharing would depend on the specific water use arrangements formulated by the participants.

This alternative involves sources controlled by other interests. The analysis of this phased scheme to convey water such a long distance dictates that a joint venture between interested developers and Park City take place. In this Study, the entire cost of the project will be used for comparison purposes.

2) Water Rights

Water rights for this alternative would be provided primarily from Weber and Davis Counties Canal Company water rights which originate in East Canyon Reservoir. An Exchange Application has already been filed for the Schuster Spring water as well as the wellsites in the Dry Hollow and Big Bear Hollow areas. Weber and Davis Counties Canal rights were used on this Exchange. Should the City desire to become involved in this alternative, it could purchase additional Weber and Davis Counties Canal water shares and apply them by amending the Exchange Application already on file. It should be noted, however, that in October 1982, the State Engineer decided to modify a thirty-year-old policy allowing use of an Exchange Application to change reservoir water to different upstream diversion points. Change Applications are now required to accomplish this. As a result, the filing of a Change Application is needed immediately. Consequently, approval and subsequent availability of the water from East Canyon Reservoir could be delayed up to two years.

If the water was intended for year-round indoor use, the water rights purchase Park City would be required to make would be for 3,293 acre-feet with a diversion allowance of 9.1 cfs (4,090 gpm).

The proposed alignments for the recycled water transmission lines from the treatment plant are all within Utah State and Interstate highway rights-of-way. Approval for access and construction within State and County rights-of-way would be required.

4) Cost to Benefit Ratio

Construct project: \$5,519,000

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Annual Costs

| | | |
|----------------------------|----------------|--|
| Construction loan payment | 767,500 | |
| Water rights payments | 915,884 | |
| Operation and maintenance: | <u>700,000</u> | (Includes pumping costs, labor, overhead etc.) |
| Total annual cost = | \$2,393,394 | |
| Flow rate potential = | 4,090 gpm | |
| Cost to benefit ratio = | \$583/gpm | for entire project |

Refer to Figure 28 for itemized Opinion of Probable Costs.

5) Governmental Approvals

All governmental approvals could probably be secured by the Spring of 1987, if preliminary reviews and design proposals are initiated immediately. Construction could also begin in the Summer of 1987.

Since this project would undergo a phased construction program, approvals could be obtained sooner. This would depend on the extent of construction and the amount of water that would be conveyed.

6) Timing

Phase I:

Spring 1986: Master planning and analysis. Spring flow monitoring and test wells.

Winter 1986: Final design completed.
Spring 1987: Governmental approvals secured.
Summer 1987: Begin construction of transmission line from Schuster Spring to Park City. Develop Schuster Spring.
Winter 1987: Complete construction; water available to Park City.

Phase II:

Summer 1989: Final design completed.
Spring 1990: Governmental approvals secured.
Summer 1990: Drill and equip wells in East Canyon.
Autumn 1991: Complete construction; additional 1,800 gpm available to Park City and others.

Phase III:

Winter 1995: Begin design of water treatment plant.

The East Canyon Springs pipeline alternative provides a large volume of water at a high cost to benefit ratio. All required water rights are presently available.

The phasing of the project would give Park City and other participants time to arrange financing and secure all land acquisitions and governmental approvals. The phasing would also reduce the cost to benefit ratio substantially.

This pipeline project is not recommended. The high cost of Phase I is not competitive with the existing Park Meadows Well facility.

D. East Canyon Creek Pipeline (Alternative No. 4)

The East Canyon Creek pipeline could provide a new year-round fresh water source for Park City. Drinking water from a water treatment plant in East Canyon could be pumped south through a pipeline to the existing Park City water distribution system. The quantity of conveyed water would be equivalent to the amount of wastewater flow contributed to the East Canyon SBSID Wastewater Treatment Plant by Park City sewer connections.

1) Physical Water

This alternative, capable of providing only 1,875 gpm of municipal quality water, would not meet the City's future water shortages. By 1995, another domestic source must be added to meet forecast source capacity requirements.

2) Water Rights

This alternative is intended to recycle the treated Park City sewage flow contribution to the SBSID treatment plant. This flow would require 1,509 acre-feet annually for indoor water. If the anticipated return flow credit is implemented, the water right requirement would be much less. If Park City can claim this water by right of reuse, no new water rights would need to be leased or purchased. This analysis will include annual costs to purchase 1,509 acre-feet of water rights.

3) Land Acquisition

Private land acquisition in the vicinity of the existing SBSID East Canyon treatment facility in the Jeremy Ranch area would be required to construct the proposed water treatment plant. If the water treatment plant is located within 200 to 300 feet of the existing plant, land acquisition may not be as difficult or time consuming. Pipelines would be laid in County and State road rights-of-way.

4) Cost to Benefit Ratio

Lump Sum Costs

Purchase water rights: \$3,018,000 (1,509 acre-feet at
\$2,000 per acre-foot)

Annual Costs

Construction loan and
water rights annual
payments:

909,900 (Total project cost =
\$3,525,000)

Operation and
maintenance:

102,000 (Includes pumping costs,
labor, overhead etc.)

Total annual cost \$1,011,900

Flow rate potential = 1,875 gpm

Cost to benefit ratio = \$540/gpm

Refer to Figure 29 for an itemized Opinion of Probable Costs.

5) Governmental Approvals

Due to the complex design of a water treatment plant, the State Department of Health's approval process may not be complete until Summer 1986. Approvals would also be required from the Utah Department of Transportation, Summit County, and the State Divisions of Water Resources and Wildlife Resources.

6) Timing

| | |
|--------------|--|
| Winter 1984: | Planning and preliminary design. |
| Spring 1985: | Water rights Exchange Application. |
| Summer 1985: | Start construction drawing design. |
| Winter 1985: | Submit plans for approval. |
| Summer 1986: | Plan approval secured. |
| Summer 1987: | Construction complete. |
| Summer 1987: | Water available for delivery to Park City. |

Due to the high cost per gallon of water delivered and the fact that this approach meets only a small fraction of Park City's future water supply requirements, this alternative is not recommended.

E. Smith-Morehouse Water Exchange (Alternative No. 5)

An exchange of irrigation quality water from the Weber River drainage for fresh drinking water from mining tunnels south of Park City is the basis of this alternative. Approximately 9.7 cfs (4,340 gpm) of impounded reservoir water from the planned enlarged Smith-Morehouse Reservoir would be released down the Weber River to the Weber-Provo Diversion Canal (Exhibit 8) just east of Oakley. At that point, the 9.7 cfs (4,340 gpm) would be diverted south through this existing canal and into the Provo River near Francis.

The water exchange would require the same amount of water to be diverted from Ontario Drain Tunnel No. 2, intercepted in Ontario Shaft No. 3, and pumped up to Drain Tunnel No. 1. The water would then flow north through the mine tunnel, and into the Silver Creek bed near Utah State Highway 224 west of American Flag Subdivision. If needed, a water treatment plant would be constructed to purify the water prior to its introduction into the system. This water is presently part of the mine water from the mountains southwest of Park City that is allowed to flow into Ontario Shaft No. 2, east through Drain Tunnel No. 2 to Drain Tunnel Creek, and into the Provo River near Hailstone, Utah.

If the quality of the mining water is satisfactory, this alternative would be a fresh water mining tunnel source similar to the existing Judge/Anchor Tunnel. The following analysis is based upon this condition. Should the water need treatment, this alternative would become either a more expensive fresh water source or an irrigation replacement source only.

1) Physical Water

The exchange plan would be capable of supplying 7,000 acre-feet (9.7 cfs) of water. This would only become possible after the completion of the planned enlargement of the Smith-Morehouse Reservoir. The water from this reservoir cannot be considered physically available until the new reservoir is filled.

There is presently 12 to 14 cfs currently flowing east through Ontario Drain Tunnel No. 2. This is enough water to allow 9.7 cfs (4,340 gpm) to be pumped up to Park City without adverse effects. Water rights to downstream users on this water are considered negligible. This drain tunnel water is, therefore, considered available immediately.

2) Water Rights

The water exchange will require a financial commitment to the Weber Basin Water Conservancy District for 7,000 acre-feet of new water impounded at the planned enlarged Smith-Morehouse Reservoir. The annual cost for leasing water rights is estimated at current prices to be about \$850,000 per year. The entire 7,000 acre-feet must be committed to as soon as possible or it will assuredly be leased to others with similar water needs. It was assumed that no water rights to downstream users have obligated the flow in Ontario Drain Tunnel No. 2.

The Weber Basin Water Conservancy District would probably require Park City to become annexed into its organization. This would incur an indeterminate amount of taxes and fees.

3) Land Acquisition

No land would need to be purchased. Easements and agreements must be secured from United Park City Mines Company to pump water up from Ontario Drain Tunnel No. 2. Easements and agreements with the mining companies are very difficult to secure. No other lands are involved with this water exchange alternative.

4) Cost to Benefit Ratio

Annual Costs

Lease water rights: \$ 850,000 (7,000 acre-feet at \$121.00 per acre-foot)

Construction loan

payment: 63,150 (Total project cost = \$454,000)

Operation and

maintenance: 425,000 (Includes pumping costs, labor, overhead etc.)

Total annual cost \$1,338,150*

Flow rate potential = 4,340 gpm

Cost to benefit ratio = \$308/gpm

*The Weber Basin Water Conservancy District might help cost share since its water rights would be involved.

Refer to Figure 30 for itemized Opinion of Probable Cost.

5) Governmental Approvals

All reviewing procedures and governmental approvals are predicted to be secured by the Winter of 1985. Construction could then begin in the Spring of 1986.

6) Timing

Winter 1983: Preliminary studies and final decision made.
Autumn 1985: Final design completed.
Winter 1985: Governmental approvals secured.
Spring 1986: Construction begins.
Autumn 1987: Project completion.
Winter 1987: Water available to Park City.

This water exchange alternative is not recommended because of excessive costs for leasing water rights and pumping the water up the mine shaft. Difficult easements and agreements with the mining companies, as well as locating pumps and piping inside deteriorating mine shafts make this alternative less attractive.

F. Smith-Morehouse Transmission Pipeline (Alternative No. 6)

A gravity pipeline 27 miles long with a water treatment plant near the planned enlarged Smith-Morehouse Reservoir highlights this alternative. About 9.7 cfs (4,340 gpm) of new lake water would be fully treated and allowed to flow by gravity west to Park City. This long, fresh-water transmission pipeline would allow for municipal connections in all of the Kamas Valley, Brown's Canyon area, and the Silver Creek Junction property east of Park City.

1) Physical Water

This alternative would be capable of supplying 9.7 cfs (4,340 gpm) of fresh drinking water to Park City. Along with the existing source capacity of 3,510 gpm, the new source meets Park City's forecast water requirements until about 2005. A gravity pipeline such as this would be free of expensive pumping and pump maintenance costs. However, the water for this pipeline would not be physically available to Park City until the Winter of 1987.

2) Water Rights

Park City would need to lease 7,000 acre-feet each year from the Weber Basin Water Conservancy District, all the available new water from the planned enlarged Smith-Morehouse Reservoir. This water would have to be leased as soon as the District offers it. If Park City waited until the completion of the reservoir enlargement to

lease the new water, other water users would surely have prior leasing arrangements on it. If Park City plans to use the new Smith-Morehouse water in any way, it must begin leasing the water at the earliest opportunity.

The Weber Basin Water Conservancy District would probably require Park City to become annexed into its organization. This would incur an indeterminate amount of taxes and fees.

3) Land Acquisition

The lands in the immediate area of the planned enlarged Smith-Morehouse Reservoir are part of Wasatch National Forest. The Weber Basin Water Conservancy District would need to obtain permits and easements from the Forest Service in order to build the water treatment plant and section of pipeline north of the plant. The remaining pipeline is planned to be installed within the State road rights-of-way. No other easements and/or land costs are expected for this section.

4) Cost to Benefit Ratio

Annual Costs

| | | |
|----------------------------|---------------|--|
| Lease water rights: | \$ 850,000 | (7,000 acre-feet at \$121 per acre-foot) |
| Construction loan payment: | 1,120,450 | (Total project cost = \$8,057,000) |
| Operation and maintenance: | <u>80,000</u> | (Includes maintenance costs, labor, overhead etc.) |

Total annual cost \$2,050,450*

Flow rate potential = 4,340 gpm

Cost to benefit ratio = \$472/gpm for municipal water

*The Weber Basin Water Conservancy District might help cost share since its rights are involved.

Refer to Figure 31 for itemized Opinion of Probable Costs.

5) Governmental Approvals

Forest Service review and approval would definitely be required. Formal approvals from the State Engineer and the State Departments of Health, Transportation, and Parks and Recreation should also be expected. The Utah Division of Water Resources would require a review period for their approvals as well. Additionally, the Environmental Protection Agency would probably want the opportunity to review and approve this alternative. The major approval effort with this project would be the water treatment plant. These approvals could be acquired by Winter 1985.

6) Timing

Winter 1983: Preliminary studies and a final decision made.

Autumn 1985: Final design complete.

Winter 1985: Governmental approvals secured.

Spring 1986: Construction begins.

Autumn 1987: Project completion.

Winter 1987: Water available to Park City.

A fresh water gravity pipeline from the mountains down to Park City is attractive in that no pumping costs would ever be experienced. The pipeline is large enough to allow a pump-free transmission system. However, the length and the high initial construction and annual water leasing costs make this alternative too expensive.

G. Weber River/Oakley Transmission Pipeline (Alternative No. 7)

This alternative is very similar to No. 6, the Smith-Morehouse Transmission Pipeline. In this proposed water supply project, eleven and one-half miles of 22-inch gravity pipeline would be eliminated. Instead, the Weber River would carry the design flow of 9.7 cfs (4,340 gpm) down to a water treatment plant located east of Oakley at the mouth of the canyon. From this point, a pump station would move the treated water west across the Kamas Valley and up to Park City. Fresh water connections would still be available to potential customers in Kamas Valley and along the pipeline route. The entire 7,000 acre-feet of impounded new water from the planned enlarged Smith-Morehouse Reservoir would need to be continuously leased by Park City.

1) Physical Water

As is the case with the longer pipeline from the enlarged reservoir, this alternative would be capable of supplying 9.7 cfs (4,340 gpm) of municipal water to Park City. Along with the existing source capacity of 3,510 gpm, the project could meet Park City's forecast water requirements until about the year 2005. The water needed for this plan would not be physically available to Park City until the Winter of 1987. It was assumed that there would be no problems associated with diverting the design flow from the Weber River at the site of the treatment plant east of Oakley.

2) Water Rights

Park City would need to lease 7,000 acre-feet each year from the Weber Basin Water Conservancy District. This is all of

the available new water from the planned enlarged Smith-Morehouse Reservoir. This water would have to be leased as soon as the District offers it. If Park City waited until the completion of the reservoir enlargement to lease the new water, other water users would surely have prior leasing arrangements on it. If Park City plans to use the new Smith-Morehouse water in any way, it must begin leasing the water at the earliest opportunity.

The Weber Basin Water Conservancy District would probably require Park City to become annexed to its organization. This would incur an indeterminate amount of taxes and fees.

3) Land Acquisition

The treatment plant is preliminarily sited on private land east of Oakley (Exhibit 10). Arrangements to buy the land needed for the entire treatment facility would have to be made. The cost of acquiring such real estate was estimated at about \$50,000 (Figure 32). The pipeline route from the plant west to Park City is planned to be built within State road rights-of-way. Engineering coordination to secure State permits would be needed prior to all pipeline construction. Obtaining the necessary land and permits is not considered a handicap.

4) Cost to Benefit Ratio

Annual Costs

Lease water rights: \$ 850,000 (7,000 acre-feet at \$121
per acre-foot)

Construction loan

payment: \$ 836,900 (Total project cost =
\$6,018,000)

Operation and

maintenance: 310,000 (Includes pumping costs,
labor, overhead etc.)

Total annual cost \$1,996,900*

Flow rate potential = 4,340 gpm

Cost to benefit ratio = \$460/gpm for municipal water

*The Weber Basin Water Conservancy District might help cost share since its water rights are involved.

Refer to Figure 32 for itemized Opinion of Probable Costs.

5) Governmental Approvals

Complete review and approval procedures would be expected from the Utah State Departments of Health and Transportation. The State Engineer and Division of Water Resources would require reviews as well. The water treatment facility would probably require the most approval work, with the Environmental Protection Agency possibly becoming involved. This alternative should expect an approval phase of at least 12 to 18 months. All approvals are considered obtainable under existing regulations.

6) Timing

Winter 1983: Preliminary studies and a final decision.
Autumn 1985: Final design completed.

Winter 1985: Governmental approvals secured.
Spring 1986: Construction begins.
Autumn 1987: Project completion.
Winter 1987: Water available to Park City.

This pipeline alternative has a high cost/benefit ratio. Anticipated pumping (power) and maintenance costs and expensive leasing of water rights create a high annual cost. Even though this fresh water transmission line would allow for a single municipal service zone from east Oakley to the planned development near Iron Mountain (sub-area No. 6), it is not cost competitive with the Park Meadows Wells.

H. Park Meadows Well No. 2 (Alternative No. 8)

It is anticipated that a second Park Meadows well could be drilled in the same proximity as the existing well. The existing Park Meadows Well is located in a proven aquifer in the Thaynes Formation. It can produce 3.34 cfs (1,500 gpm) with only 30 feet of drawdown. A new well could produce in excess of 4.2 cfs (1,900 gpm). Replacement water for both wells is needed only during the irrigation season, a maximum of six months each year.

The Park Meadows Well No. 2 is an excellent alternative because the water would come from a known fresh water aquifer in the central part of Park City. It could be pumped fairly inexpensively as the vertical pumping lift is relatively low. Pumped water could be stored in the two existing municipal storage tanks in the immediate vicinity. However, this new source must be coupled with an alternative that could provide replacement water to downstream water users during the irrigation season.

1) Physical Water

This alternative would supply approximately 4.2 cfs (1,900 gpm) of fresh drinking water. Together with Park City's existing source capacity of 7.8 cfs (3,510 gpm), and the existing Park Meadows Well No. 1 with 3.3 cfs (1,500 gpm), there would be a total of 15.4 cfs (6,910 gpm) available. This is equal to the source capacity requirements forecast for the year 2000.

2) Water Rights

For year-round municipal use, approximately 1,530 acre-feet of water rights must be obtained. Annual water rights leasing costs, using the Weber Basin Water Conservancy District's 1982 rates, would be \$185,100 (\$121 per acre-foot X 1,530 acre-feet). An annual cost to purchase rights would be approximately \$425,500.

3) Land Acquisition

The property involved in this alternative is currently owned by Park City Municipal Corporation.

4) Cost to Benefit Ratio

Annual Costs

Purchase water

| | | |
|---------|-----------|--|
| rights: | \$425,500 | (1,530 acre-feet at \$2,000 per acre-foot) |
|---------|-----------|--|

Construction loan

| | | |
|----------|--------|----------------------------------|
| payment: | 34,800 | (Total project cost = \$250,000) |
|----------|--------|----------------------------------|

Operation and

| | | |
|--------------|----------------|---|
| maintenance: | <u>150,000</u> | (Includes pump costs, labor, overhead etc.) |
|--------------|----------------|---|

Total annual cost \$610,300

Flow rate potential = 1,900 gpm

Cost to benefit ratio = \$321/gpm for municipal water

Additional costs for replacement water during the irrigation season must be considered as well. Refer to Figure 33 for an itemized Opinion of Probable Costs.

5) Governmental Approvals

Park City would need to apply for a test well permit to drill and test pump a new well on the proposed Park Meadows No. 2 well site. Once the well's flow capacity is known, the City can purchase the water rights necessary for diversion of the water into the system. An Exchange Application can then be filed with the State Engineer's Office. The other governmental approval required for implementation of a new well and pumphouse on this site would be that from the State Department of Health, Bureau of Public Water Supply. The critical path would be the water rights acquisition and the State Engineer's approval.

6) Timing

| | |
|--------------|--|
| Winter 1982: | Preliminary studies and a final decision. |
| Winter 1982: | Apply for test well permit. |
| Spring 1983: | Drill and test pump Park Meadows Well No. 2. |
| Spring 1983: | Begin final design. |
| Spring 1983: | Make Exchange Application. |
| Summer 1984: | Exchange Application approved. |
| Summer 1984: | Final design completed. |
| Autumn 1984: | Governmental approvals secured. |
| Winter 1984: | Project completion. |
| Winter 1984: | Water available to Park City. |

The recommended alternative is this new Park Meadows Well in combination with the existing well. The two wells would fit appropriately into Park City's phased water source development program and could be expected to help supply an adequate source capacity to the year 2000.

IX. SUMMATION

- A. Conclusions
- B. Recommendations
- C. Implementation Plan

IX. SUMMATION

A. CONCLUSIONS

- 1) Park City presently comprises 3,900 dwelling units. This number of units will more than triple in the next forty years.
- 2) The water supply requirement for Park City involves both the development of adequate water source capacity and the acquisition of the proper amount of water rights.
- 3) The existing water supply sources, including the Spiro Tunnel gravity pipeline, can produce an average total flow rate of approximately 3,500 gpm. This source capacity allows for about 5,950 units, based upon the recommended total water requirement per unit for 1982.
- 4) Park City could increase its source capacity to approximately 8,500 gpm if its presently developed potential sources were approved and connected to the water system. This source capacity would allow for over 14,000 units.
- 5) The recommended source capacity requirement for indoor demands is 450 gpd per unit. The recommended source capacity requirement for irrigation demands is 4,127 gpd per acre. A typical unit in 1982 averages 847 gpd.
- 6) It is in the best interest of Park City to meet with Salt Lake City and negotiate a trade for ownership of additional water rights in the Spiro Tunnel.

- 7) Park City presently controls 1,332 acre-feet of year-round water rights. Additional irrigation season and non-irrigation season water rights provide another 870 acre-feet of water rights. Together, the rights allow for use of 2,202 acre-feet and a minimum diversion allowance of 3.23 cfs (1,450 gpm). Based upon the recommended indoor water requirement of 450 gpd per unit, Park City's water rights allow about 4,630 units.
- 8) Peak diversion allowances for irrigation season water rights allow Park City 6.1 cfs (2,740 gpm) of water. Based upon the recommended indoor and outdoor water requirement for 1982 of 847 gpd per unit, Park City's water rights allow about 4,660 units.
- 9) In the years to come, Park City needs to secure and totally control enough additional year-round water rights to allow use of the source capacity needed to adequately service all new development.
- 10) The peak demand period for Park City has historically been July and August, Christmas holiday week, and President's Day weekend, regardless of occupancy rates. Data collected over a three-year period for Vail, Colorado, indicate a water use pattern similar to that experienced in Park City.
- 11) A year-round water use pattern cannot presently be documented since proper data is unavailable. Once sufficient water use records are collected, Park City could possibly justify a reduction in its water source and water rights requirements.

- 12) The recent approval by the State Engineer of the water right for Salt Lake City's share of the Spiro Tunnel water has greatly enhanced the total water source capacity potential for Park City.
- 13) Park City should always maintain an acceptable natural flow rate in the Golf Course creek by not diverting all of the available flow from the Spiro Tunnel.
- 14) In light of the locally developed physical sources and the availability of water rights in the area, Park City need not be immediately concerned with the development of additional water sources outside the area.
- 15) Park City will continue to heavily depend on mining tunnel water sources. The perpetual maintenance and eventual deterioration of such abandoned mining tunnels should be carefully considered.
- 16) Additional development and annexation outside the Study Area may require Park City to secure source capacity and water rights in addition to that recommend.

B. RECOMMENDATIONS

- 1) Increase efforts to secure State Engineer approvals of pending water rights applications.
- 2) File a claim for all water treated by the SBSID that was originally generated by Park City sewer connections.
- 3) Secure ownership of up to 60 percent of the available water rights in the Spiro Tunnel. Obtain additional year-round municipal water rights consistent with development of additional water source capacity.
- 4) Incorporate the existing Park Meadows Well into the City's water system by 1987. Drill and equip the planned Park Meadows Well No. 2 by 1992.
- 5) Monitor flows from all water sources on a weekly basis for a twelve-month period. Take water quality samples.
- 6) Continue to record overall water system use patterns on a daily basis. Continue the current customer metering program. Determine a total 12-month overall water use curve for Park City.
- 7) Categorize each water customer by location, unit type, and irrigation potential. Set up a comprehensive 12-month sampling program to substantiate total water use for specific unit types.
- 8) Petition the State Engineer for return flow credits for indoor water used during the non-irrigation season.

- 9) Adopt a water ordinance to require that newly annexed developments supply Park City with sufficient water rights and source capacity, or equivalent, consistent with their water requirements.
- 10) Investigate the extent and expected cost of a perpetual maintenance program for the mining tunnel water sources. Evaluate the benefits of installing a pipeline in each tunnel source.
- 11) Reexamine the water resource needs of Park City by the year 1995.

C. IMPLEMENTATION PLAN

Each recommendation necessitates positive action if any beneficial results are expected. Each step required to properly augment the Park City water system is outlined below. Important deadlines and anticipated expenditures are included.

1) Secure State Engineer Approvals.

- a) Schedule a meeting between representatives from the Park City Council, their water rights attorney, and their water resources engineer to discuss actions needed to expedite State Engineer approval of Exchange Application 1577, Change Application a-11857, and Change Application a-7899. Amend each to allow additional points of diversion.

Deadline for meeting and
amending applications: December 14, 1982

Estimated professional
fees: \$1,500

- b) Arrange a meeting with the State Engineer and representatives from the City Council, their water rights attorney, and their water resources engineer to explain Park City's water development plan and ask for a decision on Change Application a-11857.

Deadline for setting
December meeting: December 21, 1982

Deadline for meeting
with State Engineer: January 7, 1983

Deadline for a decision
by the State Engineer: January 21, 1983

Estimated professional
fees: \$2,500

- c) Petition for and secure a decision from the State Engineer regarding Exchange Application 1577 and Change Application a-7899.

Deadline: June 1, 1983

Estimated professional
fees: \$1,500

2) File a claim on all SBSID treated water originally generated by Park City sewer connections.

- a) Ask the City's water resource engineer to determine the actual amount of water treated by SBSID that was generated by units with sewer connections in Park City. Instruct the water rights attorney to meet with the State Engineer and determine the possibility of approval for such a claim.

Deadline for report

to City Council:

December 15, 1982

Estimated professional

fees:

\$4,000

- b) Instruct the City's water rights attorney to file a claim for this amount of water based upon Park City's right of reuse. The attorney needs to research all claims on East Canyon Creek so as not to file on water already awarded to downstream users.

Deadline for research

and filing of claim:

March 1, 1983

Estimated professional

fees:

\$2,000

- c) The water resource engineer will need to show the State Engineer how Park City plans to reuse this water. Alternative No. 2 explains a possible plan

of reusing the treated water for replacement water during the irrigation season. All evidence of Park City's plans to reuse this water needs to be presented with the filing of the claim.

Deadline for evidence
of plans for reuse: March 1, 1983

Estimated professional
fees: \$3,000

Park City should aggressively pursue this claim as approval would reserve the option to recirculate and reuse water and, thus, avoid costly purchasing of additional water rights.

3) Obtain additional year-round water rights from the Spiro Tunnel and elsewhere as needed.

- a) Request Royal Street Land Company to perfect their 20 percent share (961 acre-feet) of Spiro Tunnel water by December 1984.

Deadline for clear
title to Park City: December 1984

Estimated professional
fees: \$1,000

- b) Secure an agreement with Salt Lake City Corporation to effect a graduated trade of equivalent water rights for Park City ownership of Salt Lake water rights in the Spiro Tunnel.

Deadline for securing
an agreement with
Salt Lake City Corp.: December 1984

Estimated professional
fees: \$6,000

- c) Secure a second 20 percent share (961 acre-feet) of Spiro Tunnel water by 1992. This can be accomplished by direct purchase or indefinite lease from:

1. Greater Park City Company:

Purchase 961 acre-feet of water available from State Engineer approval of Change Application a-11857.

Estimated lump sum cost: \$2,000,000

Estimated annual cost

(11% for 15 years): \$278,000/year

2. Beaver Shingle Creek Irrigation Company:

Purchase equivalent shares of Deer Creek Reservoir water to be traded to Salt Lake City Corporation for ownership of 961 acre-feet in the Spiro Tunnel.

Estimated lump sum cost: \$2,000,000

Estimated annual cost

(11% for 15 years): \$278,000/year

3. Davis and Weber Counties Canal Stock:

Purchase equivalent shares of water to be traded to Salt Lake City Corporation for ownership of 961 acre-feet in the Spiro Tunnel

Estimated lump sum cost: \$2,000,000

Annual cost

(11% for 15 years): \$278,000/year

4. Weber Basin Water Conservancy District:

Lease 961 acre-feet of water rights indefinitely from the proposed enlarged Smith-Moorehouse Reservoir and trade to

Salt Lake City Corporation for ownership
of 961 acre-feet in the Spiro Tunnel.

Estimated annual cost: \$116,000/year

5. Weber Basin Water Conservancy District:

Lease 961 acre-feet of water rights
indefinitely from East Canyon Reservoir
and trade to Salt Lake City Corporation
for ownership of 961 acre-feet in the
Spiro Tunnel.

Estimated annual cost: \$116,000/year

Meet with representatives of each of the above
entities. Decide which arrangement would be in
the best interest of Park City.

The Weber Basin Water Conservancy District may
require Park City's annexation into its
organization. As a result, additional taxes and
fees might be levied upon Park City.

Deadline to secure
an agreement: March 1, 1989

Deadline for securing
ownership of 961
acre-feet: May 1, 1989

Estimated professional
fees: \$15,000

- d) Secure an additional 961 acre-feet of Spiro Tunnel water by 1997.

Estimated lump sum cost: \$3,000,000

Estimated professional
fees:

\$5,000

- 4) Incorporate the existing Park Meadows Well No. 1 into the water system by 1987. By 1992, drill, equip, and use the planned Park Meadows Well No. 2 for additional source capacity.

- a) Secure ownership of enough water rights from the Spiro Tunnel to allow pumping of 1,500 gpm from Park Meadows Well No. 1.

Deadline for ownership
of replacement water: December 1984

Estimated annual cost: \$0.00 (Royal Street
Land Company share)

Estimated professional
fees: \$5,000

- b) Instruct the City's water resource engineer to review approvals from the Bureau of Public Water Supply for the use of the Park Meadows Well No. 1 as Park City's next water source.

Deadline for approvals
of the new source: December 1986

Estimated professional
fees: \$2,000

- c) Energize the existing 100 horsepower submersible well pump to supply 1,100 gpm to the municipal water system.

Deadline for additional
1,100 gpm into system: June 1987

Estimated professional
fees: \$1,000

- d) Order, install, and secure approvals for a booster pump to increase source capacity from the existing well to 1,500 gpm.

Deadline for approval and
installation of the
booster: June 1991

Estimated lump sum cost: \$15,000

- e) The City Council should instruct its water rights attorney to secure Park City ownership of sufficient water rights from the Spiro Tunnel to allow pumping of up to 1,900 gpm from the new Park Meadows Well No. 2.

Deadline for ownership
of replacement water: May 1, 1989

Estimated professional
fees: \$15,000

- f) The water resource engineer for Park City should file for and secure a well permit to drill another well near the existing one.

Deadline for securing
well permit:

September 1, 1983

Estimated professional
fees:

\$2,000

- g) If the test well successfully supplies the source capacity needed, the City Council should authorize final design work for the Park Meadows Well No. 2.

Deadline for final
engineering design:

April 1, 1990

Estimated professional
fees:

\$35,000

- h) Approval from the Bureau of Public Water Supply needs to be secured to allow the No. 2 well as Park City's next water source.

Deadline for approvals: September 1, 1990

Estimated professional
fees:

\$3,000

- i) Bid proposals should be solicited and the construction work begun on the pump piping and pumphouse building.

Deadline for completion
of construction:

September 1, 1991

Estimated construction
costs: \$250,000

Estimated professional
fees: \$10,000

- j) Final construction and governmental approvals and disinfection of the well and piping should be completed prior to introduction of the well source into the system.

Deadline for completion
of final approvals and
disinfection: June 1, 1992

Estimated professional
fees: \$2,000

The maximum forecast capacity of 1,900 gpm for the planned Park Meadows Well No. 2 would then increase Park City's total source capacity to 6,910 gpm. This capacity would be adequate to service all forecast development in the Study Area to the year 2000.

5) Monitor flows from all water sources on a weekly basis for 12 months.

a) Purchase and install weirs and chart recorders on the Judge/Anchor Tunnel collection box, the Theriot Springs collection box, the Spiro Tunnel at the 6,600 foot station, the Spiro Tunnel Gravity Pipeline, the Stahle Springs, and Sullivan Spring.

Deadline for design: January 1, 1983

Deadline for
installation: February 1, 1983

Estimated Cost:
(6 X \$1,500) \$9,000

Estimated professional
fees: \$5,000

b) Obtain weekly averages of all flows from these sources. Plot the flow rate versus the week of the year for each source to determine its production pattern.

Deadline: Data collection
taken weekly

Estimated professional
fees: \$5,000

- c) Obtain a sample for chemical analysis every six months from each source. Obtain a sample for a bacteriological analysis every two months from each spring source.

Chemical Analysis

Deadlines:

1st sample January 1983
2nd sample June 1983
3rd sample December 1983

Estimated Cost: \$2,160
(\$120/sample X 3 X 6
sources)

Estimated professional
fees: \$1,500

Bacteriological Analysis

Deadlines:

Every two months beginning
January 1983 through January
1984

Estimated Cost: \$840
(\$20/sample X 7 X 6
sources)

Estimated professional
fees: \$1,000

- d) After one complete year of data collection, the City's water resource engineer should evaluate the results and determine a documented source capacity for each monitored source. He should report his conclusions to the City Council.

Deadline for data
collection and
evaluation, and
report to Council: February 1, 1984

Estimated professional
fees: \$5,000

- e) Following determination of each source capacity, the City's water rights attorney should amend all applicable water rights as needed to take full advantage of all available water.

Deadline for filing
amendments: April 1, 1984

Estimated professional
fees: \$4,000

- f) Continue monitoring activities indefinitely on a monthly basis to confirm production patterns. Reevaluate if necessary.

Deadline: Indefinitely

Estimated annual
professional fees: \$6,000

6) Continue to monitor daily overall water use.

- a) Check and/or install water meters on all service lines to water users connected to the municipal water system.

Deadline: June 1, 1983

- b) Monitor and document daily readings from flow totalizers on the outlet pipes of gravity-fed tanks and the discharge pipes of pumps feeding pressure-fed tanks.

Deadline for completion
of daily use data
collection: January 1, 1984

Estimated professional
fees: \$1,500 per month

- c) Top off each tank every week and record the reading on the totalizer to validate average weekly use data.

Deadline to commence
accumulating average
weekly use data: January 1, 1983

Estimated professional
fees: \$1,000 per month

- d) Authorize the City's water resource engineer to compile all daily use and average weekly use data and plot water use versus time for 365 days and 52 weeks, respectively.

Deadline for compilation

of accumulated data: January 15, 1984

Estimated professional

fees: \$5,000

- e) Instruct the City's water resource engineer to review the data collected during the one-year period for daily water use, average weekly water use, and average monthly water sales. The engineer shall evaluate all data and recommend a reduction or increase in the design source capacity requirement.

Deadline for

recommendation to

City Council: February 1, 1984

Estimated professional

fees: \$8,000

- f) The City's water resource engineer should then negotiate with the Bureau of Public Water Supply in an effort to lower Park City's source capacity requirement, if so indicated.

Deadline for

completion of

negotiations: April 1, 1984

Estimated professional
fees:

\$5,000

- g) The City's water resource engineer can then reduce Park City's water right requirement, if the source capacity requirement has been reduced. However, if the source capacity requirement is increased, the engineer will need to immediately determine if Park City needs to purchase additional water rights.

Deadline for
recommendations to
City Council:

April 15, 1984

Estimated professional
fees:

\$5,000

- 7) Set up a 12-month sampling program. Categorize each water use. Substantiate water use for each unit type.

The water resource engineer shall supply the City Council with an outline of each unit type and corresponding water use index.

- a) The City's water resource engineer should meet with representatives of the Public Works Department and decide which actual units will be chosen as members of the sample group. The sample units will represent each category of water use. The categories are: house, condominium, hotel/lodge, office/retail space, and restaurant.

Each sample unit will demonstrate a continuous year-round occupancy, consistent number of residents, and similar outside irrigation systems.

Deadline for determining
sample units:

December 15, 1982

Estimated professional
fees:

\$5,000

- b) The water meter for each sample unit shall be read and recorded every month for 12-months. All sample units will be chosen such that occupancy is typical for that unit type. Special attention will be given to documented occupancy rates for the hotel/lodge sample units.

Deadline to commence
reading of sample unit
meters: December 18, 1982

Deadline for completion
of reading sample unit
meters: December 31, 1983

Estimated professional
fees: \$2,000 per month

- c) Every water customer should eventually be assigned a water use index on the City's computer. Special use types such as schools, churches, car washes, athletic clubs, service stations, etc. are few in number and need not be coded at this time.

Deadline: February 1, 1983

Estimated professional
fees: \$3,000

- d) A special daily reading of each sample unit meter should be done during the eight peak water use weeks in Park City. Occupancy in each unit should be documented for each meter reading.

Deadline for completion
of special readings: December 31, 1983

Estimated professional
fees: \$8,000

- e) Park City's water resource engineer shall interpret the sample unit data and report his conclusions and water use projections to the City Council. He will incorporate his evaluations with those for Items "5" and "6" above when negotiating with the Bureau of Public Water Supply for a reduced source capacity requirement.

Deadline for report
to City Council:

February 1, 1984

Estimated professional
fees:

\$10,000

8) Petition the State Engineer for return flow credits.

- a) Arrange a meeting of representatives from the Park City Council, the Park City water rights attorney, and Park City's water resource engineer to discuss how much water can be claimed as return flow and how much Park City's water right requirement can be reduced.

Deadline: January 15, 1983

Estimated professional
fees: \$3,000

- b) Assign the City's water attorney to research Change Application a-12125 (55-6702) for a precedent. The attorney should then prepare and submit a formal request to the State Engineer to reduce Park City's water right requirement based upon return flow credits during the winter months.

Deadline: February 15, 1983

Estimated professional
fees: \$5,000

- c) Schedule a meeting with the State Engineer, the City's water attorney, and the City's water resource engineer to secure a final decision from the State Engineer regarding Park City's water rights requirement.

Deadline: March 15, 1983

Estimated professional
fees:

\$3,000

- d) Assign the water resource engineer to evaluate the beneficial results of the State Engineer's decision, if favorable, and present his findings to the Park City Council.

Deadline:

April 1, 1983

Estimated professional
fees:

\$3,000

- e) The City Council should have its water rights attorney and water resource engineer amend all applicable Park City water rights to take full advantage of the State Engineer's decision.

Deadline:

May 1, 1983

Estimated professional
fees:

\$6,000

- f) Request the water resource engineer to prepare a forecast for the City Council as to how long the present amount of Park City approved water rights will allow the existing source capacity to be used.

Deadline:

June 1, 1983

Estimated professional
fees:

\$3,000

9) Require newly annexed developments to donate physical water, water rights, or equivalent. Rewrite the water ordinance.

a) The City Council needs to revise their water development fees to reflect the use of this Study in determining the water requirements and water rights of developments.

Deadline for
ordinance:

February 1, 1983

Estimated professional
fees:

\$2,000

b) The City Council needs to meet with its attorney and engineer to draft and adopt an updated water requirement ordinance based upon the new source capacity and water rights requirements reported by the water resource engineer.

Deadline:

June 1, 1984

Estimated professional
fees:

\$8,000

10) Forecast work and expenses to continually maintain the mining tunnel sources. Estimate costs to install pipeline throughout the mining tunnel sources but not maintain them.

- a) A representative for the City Council needs to obtain an evaluation of the work required to adequately maintain the Judge/Anchor Tunnel and the Spiro Tunnel to the year 2000.

Deadline: February 1, 1983

Estimated professional
fees: \$2,000

- b) A Council representative should take this 18-year evaluation to several recognized mining contractors for a formal bid for five years of maintenance work.

A similar evaluation and solicitation of bids should be done regarding the installation of a suitably designed iron pipe throughout each mining tunnel source. These bids shall be discussed, along with the maintenance bids, by the City Council and its water resource engineer.

Deadline for bids: March 1, 1983

Estimated professional
fees: \$4,000

11) Reexamine water resource needs by 1995.

- a) The water resource engineer should present to the City Council the newly recognized water source and water right requirements resulting from his negotiations with the Bureau of Public Water Supply and the State Engineer. He should also inform Park City as to how long existing sources and rights can adequately serve development in the Study Area (i.e. negotiated requirements based upon the results obtained from Items "4" through "8" above).

Deadline to complete
negotiations and
report results to
City Council:

April 1, 1984

Estimated professional
fees:

\$10,000

- b) Plan to budget enough money to finance a comprehensive water source and water rights evaluation by the year 1995.

Deadline for budget
forecast:

October 1, 1993

- c) Take responsible action to assure the perpetuation of records of water use in Park City. Continue to budget for water rights and water resource planning.

X. TABLES, FIGURES AND EXHIBITS

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Sheet 1 1982 City Limits Over Time

Sheet 2 Study Area Over Time

TABLE 1
COMPARISON OF POPULATION GROWTH PROJECTIONS
Park City/Snyderville Basin Area

| <u>Year</u> | <u>SBSID Master Plan (1979)</u> | <u>ERA</u> | <u>Call Engineering</u> | <u>Weber Basin</u> | <u>Summit Co. Planning (1977)</u> |
|-------------|---|------------|-----------------------------|------------------------|---|
| 1981/82 | 6,700 | 21,480 | 17,010 | - | - |
| 1985 | 10,000 | 33,620 | 21,430 | 29,672 | - |
| 1990 | 18,300 | 44,710 | 26,330 | 34,951 | - |
| 1995 | 26,000 | 53,860 | 30,615 | 39,766 | 45,885+(1) |
| 2000 | 35,000 | 63,310 | 32,380(2) | 41,649 | - |
| 2010 | 44,500 | - | - | - | - |
| 2020 | 54,000 | - | - | - | - |

(1) Population for Summit County.

(2) Population for year 1997.

Note: The Call study shows a maximum growth of 59,500 people.

COMPARISON OF POPULATION GROWTH
PROJECTIONS - AREA WIDE

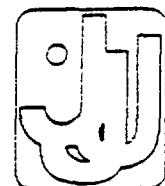


TABLE
1

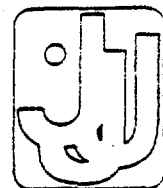
TABLE 2
COMPARISON OF POPULATION GROWTH PROJECTIONS
Park City Limits

| <u>Year</u> | <u>ERA</u> | <u>Call Engineering</u> | <u>Park City Master Plan (1972)</u> | <u>APA(1)</u> |
|-------------|------------|-----------------------------|---|---------------|
| 1980-82 | - | 11,200 | 17,000 | 5,000 |
| 1985 | 6,150 | 13,500 | - | 7,000-10,000 |
| 1990 | 7,500 | 16,000 | - | 9,000-15,000 |
| 1995 | 9,000 | 18,000 | - | - |
| 2000 | 11,000 | 18,600(2) | - | - |
| 2010 | - | - | - | - |
| 2020 | - | - | - | - |

(1) APA Silver Creek Market Analysis.

(2) A projection for 1997.

COMPARISON OF POPULATION GROWTH
PROJECTIONS - PARK CITY



TABLE

2

TABLE 3
COMPARISON OF TOTAL WATER USE
BY
SIMILAR UTAH COMMUNITIES(1)

| <u>Water System</u> | <u>Outdoor Use Index I(2)</u> | <u>Population</u> | <u>Connections</u> | <u>Average Use Per Connection</u> | |
|---------------------|-------------------------------|-------------------|--------------------|-----------------------------------|--------------------|
| | | | | <u>Gal./Mo.</u> | <u>Gal./Day(3)</u> |
| American Fork | 6.6 | 10,462 | 2,958 | 24,090 | 791 |
| Clinton | 7.4 | 3,629 | 990 | 14,740 | 484 |
| Layton | 7.4 | 17,511 | 4,365 | 22,260 | 731 |
| Lehi | 6.6 | 5,736 | 1,686 | 16,940 | 557 |
| Ogden | 6.3 | 68,978 | 19,424 | 27,060 | 889 |
| Pleasant Grove | 6.6 | 7,074 | 1,966 | 36,920 | 1,213 |
| Price | 6.3 | 10,310 | 4,124 | 19,500 | 641 |
| Provo | 7.0 | 55,593 | 10,788 | 44,990 | 1,478 |
| West Jordan | 7.6 | 11,405 | 3,200 | 25,880 | 850 |

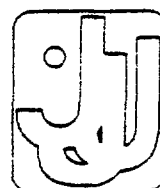
(1) Selected systems from Table 8, Hughes and Gross, 1979.

(2) Outdoor Use Index (I) as defined in Table 6, Hughes and Gross, 1979.

(3) Calculations resulting from average total use per month divided by 30.44 days per month.

Park City, Utah will be assigned an outdoor use index of about 7 ("All outside demand from domestic system; moderate amount of landscaping, average Utah climate).

**COMPARISON OF TOTAL WATER USE BY
SIMILAR UTAH COMMUNITIES**



**TABLE
3**

TABLE 4
1981 PARK CITY HOUSING INVENTORY

| <u>Areas</u> | <u>Single Family</u> | <u>Multi- Family</u> | <u>Hotel/Lodge(1)</u> | <u>Total</u> | <u>Commercial Office Area (Sq. Ft.)</u> |
|---------------------|--------------------------|--------------------------|-----------------------|--------------|---|
| 1. Old Park City | 473 | 402 | 67 | 942 | 175,340 |
| 2. Park City Resort | 35 | 761 | 238 | 1,034 | 104,691 |
| 3a. Deer Valley | 17 | 255(2) | - | 272 | - |
| 3b. Hillsides | 1 | - | - | 1 | - |
| 4. Commercial | - | 259 | 203 | 462 | 436,618 |
| 5. North Park City | <u>520</u> | <u>651</u> | <u>22</u> | <u>1,193</u> | <u>44,155</u> |
| TOTALS | 1,046 | 2,328 | 530 | 3,904 | 760,804 |

(1) Unit clusters greater than tri-plexes.

(2) The Park City Housing Inventory lists 383 multi-family units which includes 128 unfinished units not connected to the water system.

1981 PARK CITY HOUSING INVENTORY



TABLE
4

TABLE 5

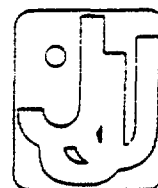
FORECAST OF DEVELOPED UNITS
WITHIN THE STUDY AREA

| <u>Sub-Area</u> | <u>1982</u> | <u>1985</u> | <u>1990</u> | <u>1995</u> | <u>2000</u> | <u>2010</u> | <u>2020</u> |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1. Old Town Park City | 2,100 | 2,350 | 2,770 | 3,190 | 3,600 | 4,000 | 4,000 |
| 2. North Park City | 1,400 | 1,560 | 1,830 | 2,100 | 2,400 | 2,500 | 2,500 |
| 3. Deer Valley | 400 | 800 | 1,460 | 2,120 | 2,500 | 2,500 | 3,000 |
| 1982 Park City Limits | 3,900 | 4,710 | 6,060 | 7,410 | 8,500 | 9,000 | 9,500 |
| 4. Flagstaff Mountain | 0 | 0 | 100 | 300 | 500 | 900 | 1,200 |
| 5. Thaynes Canyon | 0 | 0 | 30 | 70 | 100 | 150 | 200 |
| 6. Iron Mountain | 0 | 0 | 100 | 200 | 300 | 400 | 500 |
| 7. Quarry Mountain | 0 | 50 | 100 | 200 | 300 | 350 | 400 |
| 8. Round Valley | 0 | 0 | 200 | 350 | 550 | 850 | 1,000 |
| 9. Richardson Flat | 0 | 0 | 200 | 250 | 400 | 600 | 800 |
| Total Units: | 3,900 | 4,760 | 6,790 | 8,780 | 10,650 | 12,250 | 13,600 |
| Commercial Space (sq. ft.) | 760,000 | 850,000 | 1,000,000 | 1,200,000 | 1,300,000 | 1,300,000 | 1,300,000 |

Notes: Forecast based upon 12 years of historical growth in Park City (1970 to 1982).

Includes adjustments for unit sizes and types. Hotel and lodge rooms counted as 0.4 units each.

**FORECAST OF DEVELOPED UNITS WITHIN
THE STUDY AREA**



TABLE

5

TABLE 6

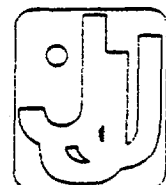
AVERAGE DAILY FORECAST OF PARK CITY RESIDENTS
AND VISITORS DURING THE SKI SEASON(1)

| <u>Year</u> | <u>Full-Time Residents(2)</u> <u>Low/High</u> | <u>Total Visitors(2)</u> <u>Low/High</u> | <u>Total Population</u> <u>Low/High</u> |
|-------------|--|---|--|
| 1982 | 4,000/ 5,000 | 1,500/ 3,000 | 5,500/ 8,000 |
| 1985 | 4,500/ 6,500 | 2,000/ 4,500 | 6,500/11,000 |
| 1990 | 5,000/ 7,500 | 4,500/ 9,500 | 9,500/17,000 |
| 1995 | 6,000/ 9,500 | 7,000/13,500 | 13,000/23,000 |
| 2000 | 7,500/12,000 | 8,000/15,000 | 15,500/27,000 |
| 2010 | 8,500/14,000 | 8,500/15,500 | 17,000/29,500 |
| 2020 | 9,000/15,000 | 9,000/16,000 | 18,000/31,000 |

(1) Forecast of full-time resident and average daily full-time visitor population in the Park City area during the ski season.

(2) Based upon approximate percentages of data in ERA, 1981 as applicable to the study area.

**AVERAGE DAILY FORECAST OF
PARK CITY RESIDENTS AND VISITORS
DURING THE SKI SEASON**



**TABLE
6**

TABLE 7

AVERAGE DAILY/PEAK MONTH FORECAST OF PARK CITY RESIDENTS
AND VISITORS DURING THE SKI SEASON(1)

| <u>Year</u> | <u>Full-Time Residents(2)</u> <u>Low/High</u> | <u>Total Visitors(2)</u> <u>Low/High</u> | <u>Total Population</u> <u>Low/High</u> |
|-------------|--|---|--|
| 1982 | 4,000/ 5,000 | 2,500/ 5,000 | 6,500/10,000 |
| 1985 | 4,500/ 6,500 | 4,000/ 7,500 | 8,500/14,000 |
| 1990 | 5,000/ 7,500 | 7,000/13,500 | 12,000/21,000 |
| 1995 | 6,000/ 9,500 | 9,000/17,500 | 15,000/27,000 |
| 2000 | 7,500/12,000 | 10,000/20,000 | 17,500/32,000 |
| 2010 | 8,500/14,000 | 10,500/21,500 | 19,000/35,000 |
| 2020 | 9,000/15,000 | 11,000/22,000 | 20,000/37,000 |

- (1) Forecast of full-time resident and average daily/peak month full-time visitor population in the Park City area during the ski season.
- (2) Based upon approximate percentages of data in ERA, 1981 as applicable to the study area.

**AVERAGE DAILY / PEAK MONTH FORECAST OF
PARK CITY RESIDENTS AND VISITORS
DURING THE SKI SEASON**



**TABLE
7**

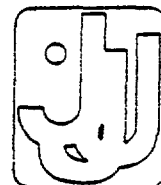
TABLE 8

PEAK DAILY/PEAK MONTH FORECAST OF PARK CITY RESIDENTS
AND VISITORS DURING THE SKI SEASON(1)

| <u>Year</u> | <u>Full-Time Residents(2)</u> <u>Low/High</u> | <u>Total Visitors(2)</u> <u>Low/High</u> | <u>Total Population</u> <u>Low/High</u> |
|-------------|--|---|--|
| 1982 | 4,000/ 5,000 | 6,000/10,000 | 10,000/15,000 |
| 1985 | 4,500/ 6,500 | 9,000/14,500 | 13,500/21,000 |
| 1990 | 5,000/ 7,500 | 13,500/22,500 | 18,500/30,000 |
| 1995 | 6,000/ 9,500 | 17,000/28,500 | 23,000/38,000 |
| 2000 | 7,500/12,000 | 20,000/34,000 | 27,500/46,000 |
| 2010 | 8,500/14,000 | 21,000/35,000 | 29,500/49,000 |
| 2020 | 9,000/15,000 | 22,000/36,000 | 31,000/51,000 |

- (1) Forecast of full-time resident and peak day/peak month full-time visitor population in the Park City area during the ski season.
- (2) Based upon approximate percentages of data in ERA, 1981 as applicable to the study area.

PEAK DAILY / PEAK MONTH FORECAST OF
PARK CITY RESIDENTS AND VISITORS
DURING THE SKI SEASON



TABLE

8

TABLE 9

COMPARISON OF AVERAGE DAILY WATER USE
AT SELECTED DEVELOPMENTS(1)

| <u>Water System</u> | <u>Total Connections</u> | <u>Average Use (gpd/conn.)</u> |
|------------------------|------------------------------|------------------------------------|
| Salt Lake City | 63,000 | 974(2) |
| Bountiful | 6,340 | 444(3) |
| Utah Sample Average | 5,340 | 608(4) |
| Snowbird | 470 | 324 |
| Teton Village | 532 | 250 |
| Sweetwater | 446 | 363 |
| Vail, Colorado(winter) | - | 800(5) |
| Vail, Colorado(summer) | - | 400(5) |
| Park City, Utah | 3,900 | 450(6) |

(1) Selected from Table 24, Lam and Hughes, 1980.

(2) Average of total water use (indoor and outdoor).

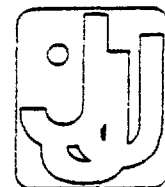
(3) Separate system for outdoor irrigation is used.

(4) Hypothetical "average" representing the mean for the study by Hughes and Gross (1979).

(5) Based upon an average occupancy of 4 persons/unit, and Lam and Hughes (1980), pg. 5.

(6) J. J. Johnson & Associates - Park City Water Resources Study, 1982 - source requirements for 1982 peak indoor demands only.

COMPARISON OF AVERAGE DAILY WATER
USE AT SELECTED DEVELOPMENTS



TABLE

9

TABLE 10

FORECAST OF INDOOR WATER REQUIREMENTS

Based on Utah State Department of Health Requirement
of 800 gpd/unit for the Study Area

| <u>Year</u> | <u>Total Units(1)</u> | <u>Daily Volume(gal)</u> | <u>Demand Flowrate (gpm)(2)</u> |
|-------------|---------------------------|------------------------------|-------------------------------------|
| 1982 | 3,900 | 3,120,000 | 2,167 |
| 1985 | 4,760 | 3,808,000 | 2,644 |
| 1990 | 6,790 | 5,432,000 | 3,772 |
| 1995 | 8,780 | 7,024,000 | 4,878 |
| 2000 | 10,650 | 8,520,000 | 5,917 |
| 2010 | 12,250 | 9,800,000 | 6,806 |
| 2020 | 13,600 | 10,880,000 | 7,556 |

(1) From Table 5.

(2) Continuous 24-hour flowrate source capacity needed for indoor demands only.

FORECAST OF INDOOR WATER
REQUIREMENT - STATE HEALTH
DEPARTMENT REQUIREMENTS

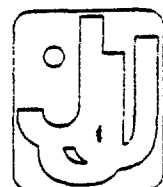


TABLE
10

TABLE 11

FORECAST OF INDOOR WATER REQUIREMENTS(1)

Based on an Anticipated Actual Required Peak
Source Capacity of 450 gpd/unit for the Study Area

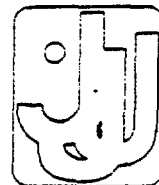
| <u>Year</u> | <u>Total Units(2)</u> | <u>Demand Volume(gpd)</u> | <u>Indoor Demand Flowrate (gpm)(3)</u> |
|-------------|---------------------------|-------------------------------|--|
| 1982 | 3,900 | 1,755,000 | 1,219 |
| 1985 | 4,760 | 2,142,000 | 1,488 |
| 1990 | 6,790 | 3,055,000 | 2,122 |
| 1995 | 8,780 | 3,951,000 | 2,744 |
| 2000 | 10,650 | 4,793,000 | 3,328 |
| 2010 | 12,250 | 5,513,000 | 3,828 |
| 2020 | 13,600 | 6,120,000 | 4,250 |

(1) Recommended indoor source capacity requirement.

(2) From Table 5.

(3) Continuous 24-hour flowrate source capacity needed for indoor demands.

FORECAST OF INDOOR WATER
REQUIREMENT - ANTICIPATED ACTUAL
AVERAGE DAILY SOURCE REQUIREMENT



TABLE

11

TABLE 12

AVERAGE WATER USE FOR SELECTED COMMERCIAL SPACES
(in Olympus Hills Mall, Salt Lake City)

| <u>Commercial Space</u> | <u>Gross Area(1)</u> | <u>Annual Volume(2)</u> | <u>Average Use(3)</u> |
|---|----------------------|-------------------------|-----------------------|
| Bowling Alley | 22,000 s.f. | 33,200 c.f. | 0.03 gpd/s.f. |
| Grocery Store | 23,500 | 18,500 | 0.02 |
| Department Store | 23,200 | 32,300 | 0.03 |
| Candy Store | 2,064 | 7,200 | 0.07 |
| Large Drug Store | 29,400 | 27,900 | 0.02 |
| Small Bank | 1,550 | 2,300 | 0.03 |
| Park City 1982 Water Resources Study | - | - | 0.05 |

(1) From Manager, Olympus Hills Mall, June 1982.

(2) From Salt Lake City Water Department, May 1982.

(3) Calculated for year comprising 365.25 days.

AVERAGE WATER USE AT SELECTED
COMMERCIAL SPACES

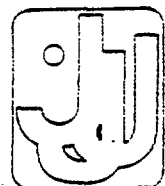


TABLE
12

TABLE 13
FORECAST OF POTENTIAL IRRIGABLE ACREAGES
IN THE STUDY AREA

| <u>Sub-Area</u> | <u>1982</u> | <u>1985</u> | <u>1990</u> | <u>1995</u> | <u>2000</u> | <u>2010</u> | <u>2020</u> |
|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1. Old Town Park City | 105 | 120 | 140 | 160 | 190 | 205 | 210 |
| 2. North Park City | 210 | 234 | 275 | 315 | 360 | 370 | 380 |
| 3. Deer Valley | 50 | 100 | 185 | 265 | 310 | 320 | 330 |
| 1982 Park City Limits | 365 | 454 | 600 | 740 | 860 | 895 | 920 |
| 4. Flagstaff Mountain | 0 | 0 | 13 | 38 | 63 | 113 | 150 |
| 5. Thaynes Canyon | 0 | 0 | 5 | 11 | 15 | 23 | 30 |
| 6. Iron Mountain | 0 | 0 | 20 | 40 | 60 | 80 | 100 |
| 7. Quarry Mountain | 0 | 8 | 15 | 30 | 45 | 53 | 60 |
| 8. Round Valley | 0 | 0 | 40 | 70 | 110 | 170 | 200 |
| 9. Richardson Flat | 0 | 0 | 40 | 50 | 80 | 120 | 160 |
| Total Acres: | 365 | 462 | 733 | 979 | 1,233 | 1,454 | 1,620 |

**FORECAST OF POTENTIAL IRRIGABLE
ACREAGE**



**TABLE
13**

TABLE 14

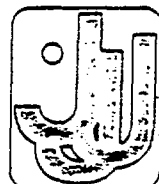
FORECAST OF OUTDOOR WATER REQUIREMENTS(1)

Based on 1.9 Acre-Feet of Irrigation
Water Per Acre Per 150 Day Summer Season(2)

| <u>Year</u> | <u>Single Family(3)</u> | <u>Multi-Family(4)</u> | <u>Daily Outdoor Demand Volume(5)</u> | <u>Outdoor Demand Flowrate(6)</u> |
|-------------|-------------------------|------------------------|---------------------------------------|-----------------------------------|
| 1982 | 732 gpm | 314 gpm | 1.51 MGal(7) | 1,046 gpm |
| 1985 | 927 | 397 | 1.91 | 1,324 |
| 1990 | 1,471 | 630 | 3.03 | 2,101 |
| 1995 | 1,964 | 842 | 4.04 | 2,806 |
| 2000 | 2,404 | 1,060 | 5.09 | 3,534 |
| 2010 | 2,917 | 1,250 | 6.00 | 4,167 |
| 2020 | 3,250 | 1,393 | 6.69 | 4,643 |

- (1) Recommended outdoor source capacity requirement.
- (2) Refer to Section III, Water Source and Water Rights Requirements.
- (3) Forecast requirements based on historic growth trend of about 70% new units being single-family.
- (4) Forecast requirements based on historic growth trend of about 30% new units being multi-family.
- (5) Total of single-family and multi-family outdoor daily demand volume.
- (6) Continuous 24-hour flow rate source capacity needed for outdoor demands.
- (7) MGal = million gallons.

**FORECAST OF OUTDOOR WATER
REQUIREMENT**



**TABLE
14**

TABLE 15

COMPOSITE FORECAST OF INDOOR AND OUTDOOR WATER REQUIREMENTS(1)

Forecasted for the Study Area When Based On
State Health Requirements and State Engineer's Guidelines

| <u>Year</u> | <u>Indoor Demand(2)</u> | <u>Outdoor Demand(3)</u> | <u>Composite Demand Flow Rate</u> |
|-------------|-------------------------|--------------------------|-----------------------------------|
| 1982 | 2,167 gpm | 1,204 gpm | 3,371 gpm |
| 1985 | 2,644 | 1,469 | 4,113 |
| 1990 | 3,772 | 2,022 | 5,794 |
| 1995 | 4,878 | 2,710 | 7,588 |
| 2000 | 5,917 | 3,287 | 9,204 |
| 2010 | 6,806 | 3,781 | 10,587 |
| 2020 | 7,556 | 4,198 | 11,754 |

- (1) These required flow rates are not recommended. See Table 16 and Section III for recommended flow rates.
- (2) From Table 10.
- (3) Based upon 560 gpd per single family unit and 175 gpd per multi-family and hotel/lodge unit. Includes assumption of 70% of the new units being single family with 30% as multi-family and hotel/lodge units.

COMPOSITE FORECAST OF INDOOR AND
OUTDOOR WATER REQUIREMENTS - STATE
HEALTH REQUIREMENTS AND STATE
ENGINEER GUIDELINES

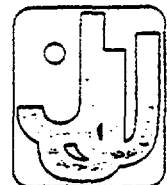


TABLE
15

TABLE 16

COMPOSITE INDOOR AND OUTDOOR WATER REQUIREMENTS(1)

Forecast for the Study Areas When Based On
Anticipated Actual Required Peak Source Capacities

| <u>Year</u> | <u>Indoor Demand(2)</u> | <u>Outdoor Demand(3)</u> | <u>Composite Demand Flow Rate</u> |
|-------------|-------------------------|--------------------------|-----------------------------------|
| 1982 | 1,219 gpm | 1,046 gpm | 2,265 gpm |
| 1985 | 1,488 | 1,324 | 2,812 |
| 1990 | 2,122 | 2,101 | 4,223 |
| 1995 | 2,744 | 2,806 | 5,550 |
| 2000 | 3,328 | 3,534 | 6,862 |
| 2010 | 3,828 | 4,167 | 7,995 |
| 2020 | 4,250 | 4,643 | 8,893 |

(1) Recommended indoor and outdoor source capacity requirements.

(2) From Table 11, Column 4.

(3) From Table 14, Column 5.

Commercial space water demands are included in Table 17, Total Forecast of Water Source Requirements.

COMPOSITE FORECAST OF INDOOR AND
 OUTDOOR WATER REQUIREMENTS -
 ANTICIPATED ACTUAL AVERAGE DAILY
 SOURCE REQUIREMENTS

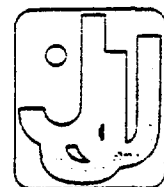


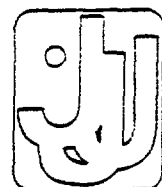
TABLE
16

TABLE 17
TOTAL FORECAST OF WATER SOURCE REQUIREMENTS
FOR THE STUDY AREA(1)

| Year | Indoor(2) | Outdoor(3) | Commercial(4) | Total Flow(1) |
|------|-----------|------------|---------------|---------------|
| 1982 | 1,219 gpm | 1,046 gpm | 26 gpm | 2,291 gpm |
| 1985 | 1,488 | 1,324 | 30 | 2,842 |
| 1990 | 2,122 | 2,101 | 35 | 4,258 |
| 1995 | 2,744 | 2,806 | 42 | 5,592 |
| 2000 | 3,328 | 3,534 | 45 | 6,907 |
| 2010 | 3,828 | 4,167 | 45 | 8,040 |
| 2020 | 4,250 | 4,643 | 45 | 8,938 |

- (1) Recommended total source capacity requirement.
- (2) Per recommended Forecast of Indoor Water Requirements, Table 11.
- (3) Per recommended Forecast of Outdoor Water Requirements, Table 14.
- (4) Per Forecast of Developed Units, Table 5.

**TOTAL FORECAST OF WATER SOURCE
REQUIREMENTS FOR THE STUDY AREA**



**TABLE
17**

TABLE 18

EXISTING AND POTENTIAL SOURCE CAPACITIES

A. Existing Supply Sources:

| | |
|--------------------------------|------------------|
| Judge/Anchor Tunnel | 1,100 gpm |
| Alliance Tunnel | 100 gpm |
| Theriot Spring | 900 gpm |
| Pacific Bridge Well | 210 gpm |
| Spiro Tunnel Gravity Pipeline* | <u>1,200 gpm</u> |
| Subtotal A | 3,510 gpm |

B. Potential Supply Sources:

| | |
|-------------------------------------|---------------|
| Spiro Tunnel Pipeline and Pumphouse | 2,840 gpm |
| Park Meadows Well | 1,500 gpm |
| Sullivan Springs | 592 gpm |
| Stahle Spring | <u>85 gpm</u> |
| Subtotal B | 5,017 gpm |

| | |
|------------------|------------------|
| Total of A and B | <u>8,527 gpm</u> |
|------------------|------------------|

*The approval granted by the State Engineer regarding the water right for this diversion has been appealed and is subject to change.

EXISTING AND POTENTIAL
SOURCE CAPACITIES



TABLE
18

TABLE 19

**1982 PARK CITY LIMITS
COMPARISON OF SOURCE CAPACITIES AND WATER RIGHT REQUIREMENTS**

Sheet 1 of 2

| | Year | 1982 | 1985 | 1990 | 1995 | 2000 | 2010 | 2020 |
|-------------------------------|---------|------|------|--------|--------|--------|--------|--------|
| 1982 City Limits | Units | 3900 | 4710 | 6060 | 7410 | 8500 | 9000 | 9500 |
| Source Capacity | | | | | | | | |
| (1) Source Capacity Required | (gpm) | 2265 | 2773 | 3614 | 4437 | 5121 | 5378 | 5606 |
| (2) Existing Source Capacity | (gpm) | 3510 | 3510 | 3510 | 3510 | 3510 | 3510 | 3510 |
| (3) Source Surplus/ (Deficit) | (gpm) | 1245 | 737 | (104) | (927) | (1611) | (1868) | (2096) |
| Diversion Allowance | | | | | | | | |
| (4) Required Diversion Rights | (cfs) | 5.05 | 6.18 | 8.05 | 9.89 | 11.41 | 11.98 | 12.49 |
| (5) Approved Diversion Rights | (cfs) | 6.13 | 6.13 | 6.13 | 6.13 | 6.13 | 6.13 | 6.13 |
| (6) Rights Surplus/ (Deficit) | (cfs) | 1.08 | 0.05 | (1.92) | (3.76) | (5.28) | (5.85) | (6.36) |
| Water Rights | | | | | | | | |
| (7) Required Water Rights | (ac-ft) | 1674 | 2047 | 2664 | 3270 | 3771 | 3963 | 4137 |
| (8) Approved Water Rights | (ac-ft) | 2202 | 2202 | 2202 | 2202 | 2202 | 2202 | 2202 |
| (9) Rights Surplus/ (Deficit) | (ac-ft) | 528 | 155 | (462) | (1068) | (1569) | (1761) | (1935) |

- (1) From Table 17.
 (2) From Table 18.
 (3) Line (2) minus Line (1) = Line (3).
 (4) From Table 27.
 (5) From Figure 1, high flow allowance.
 (6) Line (5) minus Line (4) = Line (6).
 (7) From Table 27.
 (8) From Figure 1.
 (9) Line (8) minus Line (7) = Line (9).

**COMPARISON OF SOURCE CAPACITIES
AND WATER RIGHTS REQUIREMENTS
1982 CITY LIMITS**

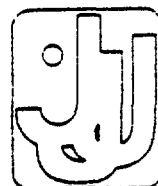
SHEET 1
TABLE**19**

TABLE 19

THE STUDY AREA
COMPARISON OF SOURCE CAPACITIES AND WATER RIGHT REQUIREMENTS

Sheet 2 of 2

| | Year | 1982 | 1985 | 1990 | 1995 | 2000 | 2010 | 2020 |
|---------------------------------------|-------|------|--------|--------|--------|--------|---------|---------|
| The Study Area | Units | 3900 | 4760 | 6790 | 8780 | 10,650 | 12,250 | 13,600 |
| Source Capacity | | | | | | | | |
| (1) Source Capacity Required (gpm) | | 2291 | 2842 | 4258 | 5592 | 6907 | 8040 | 8938 |
| (2) Existing Source Capacity (gpm) | | 3510 | 3510 | 3510 | 3510 | 3510 | 3510 | 3510 |
| (3) Source Surplus/ (Deficit) (gpm) | | 1219 | 668 | (748) | (2082) | (3397) | (4530) | (5428) |
| Diversion Allowance | | | | | | | | |
| (4) Required Diversion Rights (cfs) | | 5.10 | 6.33 | 9.49 | 12.46 | 15.39 | 17.91 | 19.92 |
| (5) Approved Diversion Rights (cfs) | | 6.13 | 6.13 | 6.13 | 6.13 | 6.13 | 6.13 | 6.13 |
| (6) Rights Surplus/ (Deficit) (cfs) | | 1.03 | (0.20) | (3.36) | (6.33) | (9.26) | (11.78) | (13.79) |
| Water Rights | | | | | | | | |
| (7) Required Water Rights (ac-ft) | | 1674 | 2075 | 3100 | 4068 | 5020 | 5842 | 6497 |
| (8) Approved Water Rights (ac-ft) | | 2202 | 2202 | 2202 | 2202 | 2202 | 2202 | 2202 |
| (9) Rights Surplus/ (Deficit) (ac-ft) | | 528 | 127 | (898) | (1866) | (2818) | (3640) | (4295) |

- (1) From Table 17.
- (2) From Table 18.
- (3) Line (2) minus Line (1) = Line (3).
- (4) From Table 27.
- (5) From Figure 1, high flow allowance.
- (6) Line (5) minus Line (4) = Line (6).
- (7) From Table 27.
- (8) From Figure 1.
- (9) Line (8) minus Line (7) = Line (9).

**COMPARISON OF SOURCE CAPACITIES
AND WATER RIGHTS REQUIREMENTS
STUDY AREA**

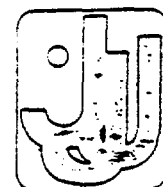
SHEET 2
TABLE**19**

TABLE 20
ESTIMATED AVERAGE SKI SEASON WASTEWATER FLOWS

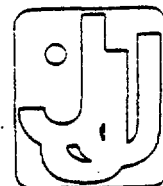
For the East Canyon and
Silver Creek Drainage Areas

| <u>Year</u> | <u>East Canyon Average Daily Wastewater Flow(1)</u> | <u>Silver Creek Average Daily Wastewater Flow(2)</u> | <u>Total Average Daily Wastewater Flow</u> |
|-------------|---|--|--|
| 1982 | 0.23 MGD | 0.47 MGD | 0.70 MGD |
| 1985 | 0.32 | 0.63 | 0.95 |
| 1990 | 0.47 | 0.93 | 1.40 |
| 1995 | 0.60 | 1.20 | 1.80 |
| 2000 | 0.70 | 1.40 | 2.10 |
| 2010 | 0.80 | 1.60 | 2.40 |
| 2020 | 0.90 | 1.80 | 2.70 |

(1) Based upon an anticipated treatment of 33% of the total sewerage flow from Park City.

(2) Based upon an anticipated treatment of 67% of the total sewerage flow from Park City.

**ESTIMATED AVERAGE SKI SEASON
WASTEWATER FLOW**



**TABLE
20**

TABLE 21
ESTIMATED PEAK SKI SEASON WASTEWATER FLOWS

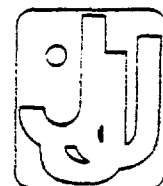
For the East Canyon and Silver Creek
Wastewater Drainage Areas

| <u>Year</u> | <u>East Canyon Average Daily Wastewater Flow(1)</u> | <u>Silver Creek Average Daily Wastewater Flow(2)</u> | <u>Total Average Daily Wastewater Flow</u> |
|-------------|---|--|--|
| 1982 | 0.42 MGD | 0.83 MGD | 1.25 MGD |
| 1985 | 0.58 | 1.17 | 1.75 |
| 1990 | 0.83 | 1.67 | 2.50 |
| 1995 | 1.02 | 2.03 | 3.05 |
| 2000 | 1.23 | 2.47 | 3.70 |
| 2010 | 1.32 | 2.63 | 3.95 |
| 2020 | 1.37 | 2.73 | 4.10 |

(1) Based upon an anticipated treatment of 33% of the total sewerage flow from Park City.

(2) Based upon an anticipated treatment of 67% of the total sewerage flow from Park City.

**ESTIMATED PEAK SKI SEASON
WASTEWATER FLOW**



**TABLE
21**

TABLE 22

ESTIMATED AVERAGE IRRIGATION SEASON WASTEWATER FLOWS
FOR THE STUDY AREAEast Canyon and Silver Creek
Wastewater Drainage Areas

| <u>Year</u> | <u>East Canyon Average Daily Wastewater Flow(1)</u> | <u>Silver Creek Average Daily Wastewater Flow(2)</u> | <u>Total Average Daily Wastewater Flow(3)</u> |
|-------------|---|--|---|
| 1982 | 0.23 MGD | 0.45 MGD | 0.68 MGD |
| 1985 | 0.28 | 0.55 | 0.83 |
| 1990 | 0.40 | 0.79 | 1.19 |
| 1995 | 0.51 | 1.03 | 1.54 |
| 2000 | 0.62 | 1.24 | 1.86 |
| 2010 | 0.71 | 1.43 | 2.14 |
| 2020 | 0.79 | 1.59 | 2.38 |

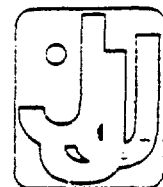
(1) Based upon an anticipated treatment of 33% of the total sewerage flow from Park City.

(2) Based upon an anticipated treatment of 67% of the total sewerage flow from Park City.

(3) Based upon Table 5, 2.5 people per unit, 70% occupancy, and 100 gpcd* sewerage contribution.

*Gallons per capita per day.

ESTIMATED AVERAGE IRRIGATION
SEASON WASTEWATER FLOW



TABLE

22

TABLE 23

INDOOR RETROFIT WATER SAVING DEVICES FOR EXISTING RESIDENCES

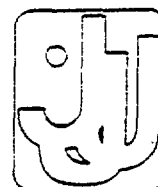
From Table 11, Retrofit Devices for Existing Housing
AWWA Water Conservation Management, 1981

| <u>Fixture</u> | <u>Device (Function)</u> | <u>Water Savings</u> | <u>Estimated Unit Water Savings GPCD</u> | <u>Unit Cost of Water Saved \$/1,000 Gallons</u> |
|-----------------|-----------------------------------|----------------------|--|--|
| Toilet | Two displacement bottles flush(1) | 1/2 gal/flush | 2.3 | 0-0.04 |
| Toilet | Water closet dam(1) | 1 gal/flush | 4.5 | 0.43-0.64 |
| Toilet | Dual-flush(1) | 3-1/2 gal/flush | 15.7 | 23.00 |
| Shower | Flow restrictor(2) | 1-1/2 gpm | 6.7 | 0.04-0.29 |
| Shower | Reduced flow shower head(2) | 1-1/2 gpm | 6.7 | 0.18-0.90 |
| Shower | Cut-off valve(3) | - | - | - |
| Faucets | Aerators(4) | - | 0.5 | 1.40 |
| Hot water pipes | Insulation(6) | - | 0.5 | 2.50 |
| Water hook-up | Pressure-reducing valve(7) | - | 3.0 | 2.90 |

Sources: (1) Water Conservation in California. California Dept. Water Resources. Bull. 198, Sacramento, Calif. (May 1976). (2) Flack, J.E. ET AL. Achieving Urban Water Conservation, A Handbook. Colorado Water Res. Inst. Completion Rept. 80. Colorado State Univ., Fort Collins, Colo. (Sept. 1977). (3) Nelson, J.O. North Marin's Compendium of Water Saving Ideas. North Marin County Water Dist., Novato, Calif. (Aug. 1, 1976).

- (1) Reduces water volume used.
- (2) Limits flow to 3 gpm.
- (3) Limits duration of flow.
- (4) Reduces splashing, enhances flow aesthetics, gives appearance of greater flow.
- (5) Automatically adjusts water temperature.
- (6) Reduces warm-up time of water from fixture.
- (7) Reduces pressure and water volume used.

**INDOOR RETROFIT WATER-SAVING
DEVICES FOR EXISTING RESIDENCES**



**TABLE
23**

INDOOR NEW WATER SAVING DEVICES FOR NEW CONSTRUCTION

From Table 12, Devices for New Construction
AWWA Water Conservation Management, 1981

| <u>Fixture</u> | <u>Device (Function)</u> | <u>Water Savings</u> | <u>Estimated Unit Water Savings GPCD</u> | <u>Unit Cost of Water Saved \$/1,000 Gallons</u> |
|--------------------|---|----------------------|--|--|
| Toilet | Low-flush toilet 3-1/2 gal/flush(1) | 2 gal/flush | 10.0 | 0.43-0.64 |
| Toilet | Two displacement bottles(1) | 1/2 gal/flush | 2.3 | 0-0.04 |
| Toilet | Water closet dam(1) | 1 gal/flush | 4.5 | 0.43-0.64 |
| Toilet | Dual-flush(1) | 3-1/2 gal/flush | 15.7 | 23.00 |
| Shower | Reduced flow shower head(2) | 1-1/2 gpm | 6.7 | 0.18-0.90 |
| Shower | Cut-off valve(3) | - | - | - |
| Shower | Flow restrictor(2) | 1-1/2 gpm | 6.7 | 0.04-0.29 |
| Faucets | Aerators(4) | - | 0.5 | 1.40 |
| Faucets | Thermostatic mixing valve(5) | - | - | - |
| Hot water pipes | Insulation(6) | - | 2.0 | 5.00 |
| Water hook-up | Pressure-reducing valve(7) | - | 3.0 | 1.20 |
| Appliances | Water efficient dish- washing appliances(1) | 6-gal/cycle | 2.0 | 0 |
| Appliances | Water-efficient clothes-washing machines(1) | 14-gal/cycle | 3.5-7.0 | 1.20-2.41 |

(1) Reduces water volume used.

(2) Limits flow to 3 gpm.

(3) Limits duration of flow.

(4) Reduces splashing, enhances flow aesthetics, gives appearance of greater flow.

(5) Automatically adjusts water temperature.

(6) Reduces warm-up time of water from fixture.

(7) Reduces pressure and water volume used.

**INDOOR NEW WATER-SAVING
DEVICES FOR NEW CONSTRUCTION**



TABLE

24

TABLE 25

OUTDOOR NEW AND RETROFIT WATER-SAVING DEVICES

| <u>Device</u> | <u>Function</u> | <u>Estimated Water Savings Percentage Range Total Outdoor Use</u> | <u>Estimated Water Savings GPCD</u> | <u>Estimated Additional Costs (\$)</u> | <u>Unit Cost of Water Saved \$/1,000 Gal.</u> |
|----------------------------------|---|---|---|--|---|
| Trickle-drip irrigation | Reduce flow rate to shrubs, trees, etc. | 3 - 5% | 2 - 3 | \$100 - \$200 | \$7.75 |
| Automatic sprinkler system | Limits irrigation flows to optimal watering conditions | 12 | 60 | \$ 65 | \$0.80 |
| Alternative landscaping | Reduce irrigation requirement | 40% | - | - | - |

Source: AWWA 1981.

OUTDOOR NEW AND RETROFIT
WATER SAVING DEVICES

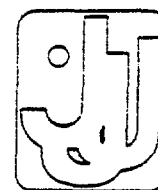


TABLE
25

TABLE 26

ANNUAL COST COMPARISONS OF THE ALTERNATIVES

| No. | Alternative | Annual Cost | Cost/Water Ratio |
|-----|------------------------------------|---------------|------------------|
| 1. | Satellite Treatment Plants* | \$1,946,00.00 | \$1,508.00/gpm |
| 2. | Recycle Wastewater Effluent* | 215,818.00 | 167.00/gpm |
| 3. | East Canyon Springs Pipeline | 2,383,384.00 | 583.00/gpm |
| 4. | East Canyon Creek Pipeline | 1,011,900.00 | 540.00/gpm |
| 5. | Smith-Morehouse Water Exchange | 1,338,150.00 | 308.00/gpm |
| 6. | Smith-Morehouse Reservoir Pipeline | 2,050,450.00 | 472.00/gpm |
| 7. | Weber River/Oakley Pipeline | 1,996,900.00 | 460.00/gpm |
| 8. | Park Meadows Well No. 2** | 610,300.00 | 321.00/gpm |

NOTES: Annual costs are based upon yearly payments for a construction loan financed at 11 percent over 15 years.

The cost/water ratio is the annual cost divided by the flow rate potential of the alternative.

* Alternatives 1 and 2 provide irrigation replacement water only.

** This alternative requires irrigation season replacement water.

ANNUAL COST COMPARISON
OF THE ALTERNATIVES

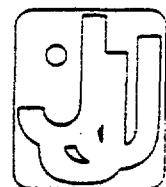


TABLE
26

TABLE 27
SOURCE CAPACITY AND WATER RIGHTS REQUIREMENTS OVER TIME

| Service Areas over Time | Units(1) | Water Source Requirements(2) | Water Rights Requirements(3) |
|-------------------------|----------|------------------------------|------------------------------|
| <u>1982</u> | | | |
| 1982 City limits | 3,900 | 2,265 gpm | 1,674 ac-ft |
| Study Area | 3,900 | 2,291 | 1,674 |
| <u>1985</u> | | | |
| 1982 City limits | 4,710 | 2,773 | 2,047 |
| Study Area | 4,760 | 2,842 | 2,075 |
| <u>1990</u> | | | |
| 1982 City limits | 6,060 | 3,614 | 2,664 |
| Study Area | 6,790 | 4,258 | 3,100 |
| <u>1995</u> | | | |
| 1982 City limits | 7,410 | 4,437 | 3,270 |
| Study Area | 8,780 | 5,592 | 4,068 |
| <u>2000</u> | | | |
| 1982 City limits | 8,500 | 5,121 | 3,771 |
| Study Area | 10,650 | 6,907 | 5,020 |
| <u>2010</u> | | | |
| 1982 City limits | 9,000 | 5,378 | 3,963 |
| Study Area | 12,250 | 8,040 | 5,842 |
| <u>2020</u> | | | |
| 1982 City limits | 9,500 | 5,606 | 4,137 |
| Study Area | 13,600 | 8,938 | 6,497 |

- 1) Proportional density allocation per Table 5.
- 2) Total Source Capacity based upon unit requirements from Table 17.
- 3) Computed water rights correspondent to required source capacity. Total of both indoor/domestic and outdoor/irrigation water rights based upon proportional uses shown in Table 17.

SOURCE CAPACITY AND WATER RIGHTS REQUIREMENTS



**TABLE
27**

TABLE 28
EXISTING SOURCES AND ALLOWABLE UNITS

| Source | Average Daily Volume(1) | Units Served(2) |
|-------------------------------|-------------------------|-----------------|
| Judge/Anchor Tunnel | 1.73 MGD | 2,040 |
| Alliance Tunnel | 0.14 MGD | 170 |
| Theriot Spring | 1.15 MGD | 1,360 |
| Pacific Bridge Well | <u>0.30 MGD</u> | <u>357</u> |
| Subtotal | 3.32 | 3,927 |
| Spiro Tunnel Gravity Pipeline | <u>1.73 MGD</u> | <u>2,040</u> |
| Total | <u>5.05 MGD</u> | <u>5,967</u> |

(1) Per Section IV, Existing Supply Sources.

(2) Based upon the average 1982 water requirement of 847 gpd per unit.

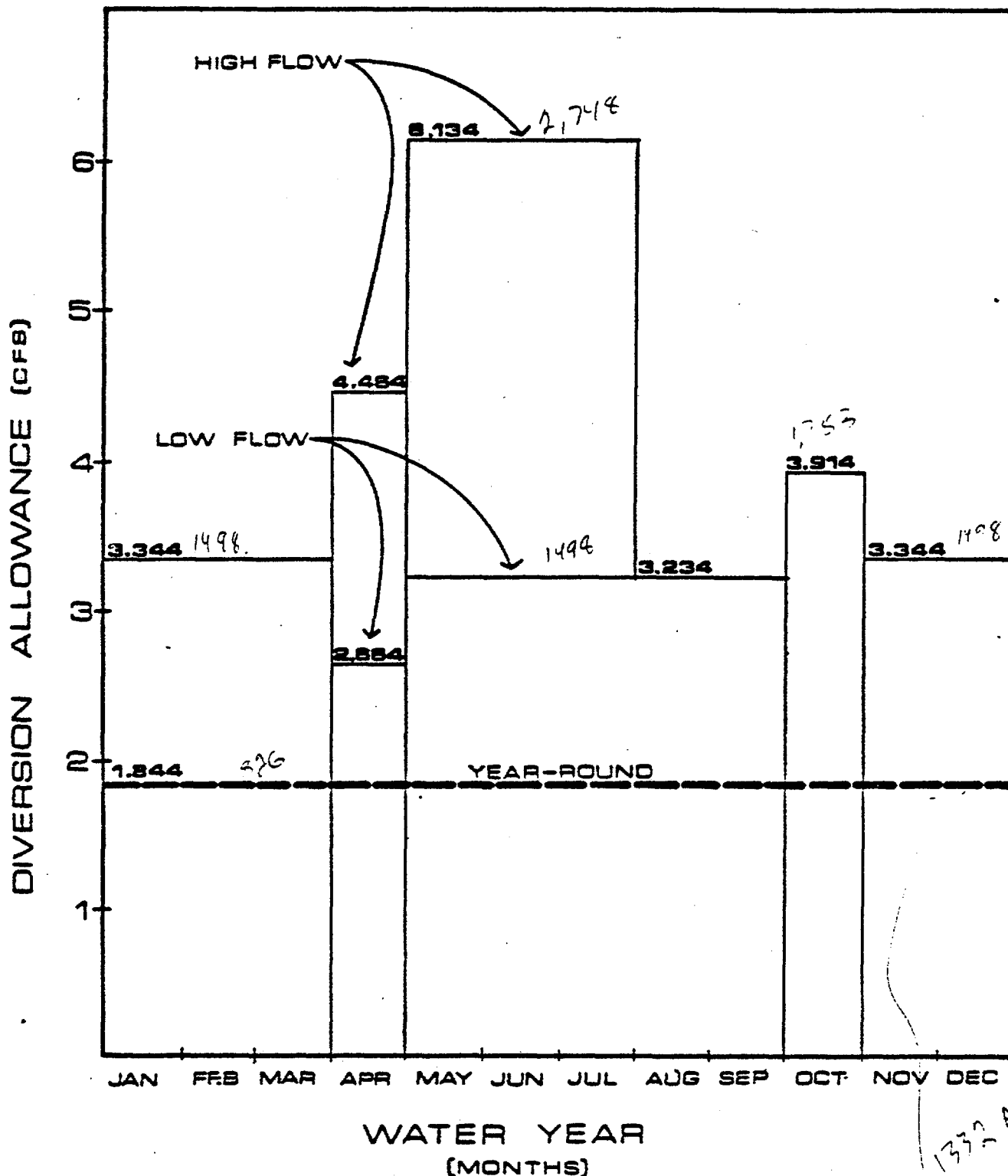
**EXISTING SOURCES AND
ALLOWABLE UNITS**



**TABLE
28**

B. LIST OF FIGURES

1. Water Rights Diversion Allowance
2. Location Map - Judge/Anchor Tunnel
3. Chemical Analysis - Judge/Anchor Tunnel, 1974
4. Chemical Analysis - Judge/Anchor Tunnel, 1981
5. Location Map - Alliance Tunnel
6. Chemical Analysis - Alliance Tunnel, 1974
7. Chemical Analysis - Alliance Tunnel, 1981
8. Location Map - Theriot Springs
9. Chemical Analysis - Theriot Springs, 1975
10. Chemical Analysis - Theriot Springs, 1981
11. Bacteriological Analysis - Theriot Springs, 1981
12. Location Map - Pacific Bridge Well
13. Well Drillers Report - Pacific Bridge Well
14. Chemical Analysis - Pacific Bridge Well, 1974
15. Chemical Analysis - Pacific Bridge Well, 1980
16. Pump Drawdown Curve - Pacific Bridge Well
17. Pump Drawdown curve - Pacific Bridge Well - 1982
18. Chemical Analysis - Spiro Tunnel, 1971
19. Chemical Analysis - Spiro Tunnel, 1974
20. Chemical Analysis - Spiro Tunnel, 1979
21. Chemical Analysis - Thaynes Shaft, 1974
22. Location Map - Present Developed Potential Sources
23. Well Drillers Report - Park Meadows Well
24. Chemical Analysis - Park Meadows Well, 1979
Bacteriological Analysis - Park Meadows Well, 1979

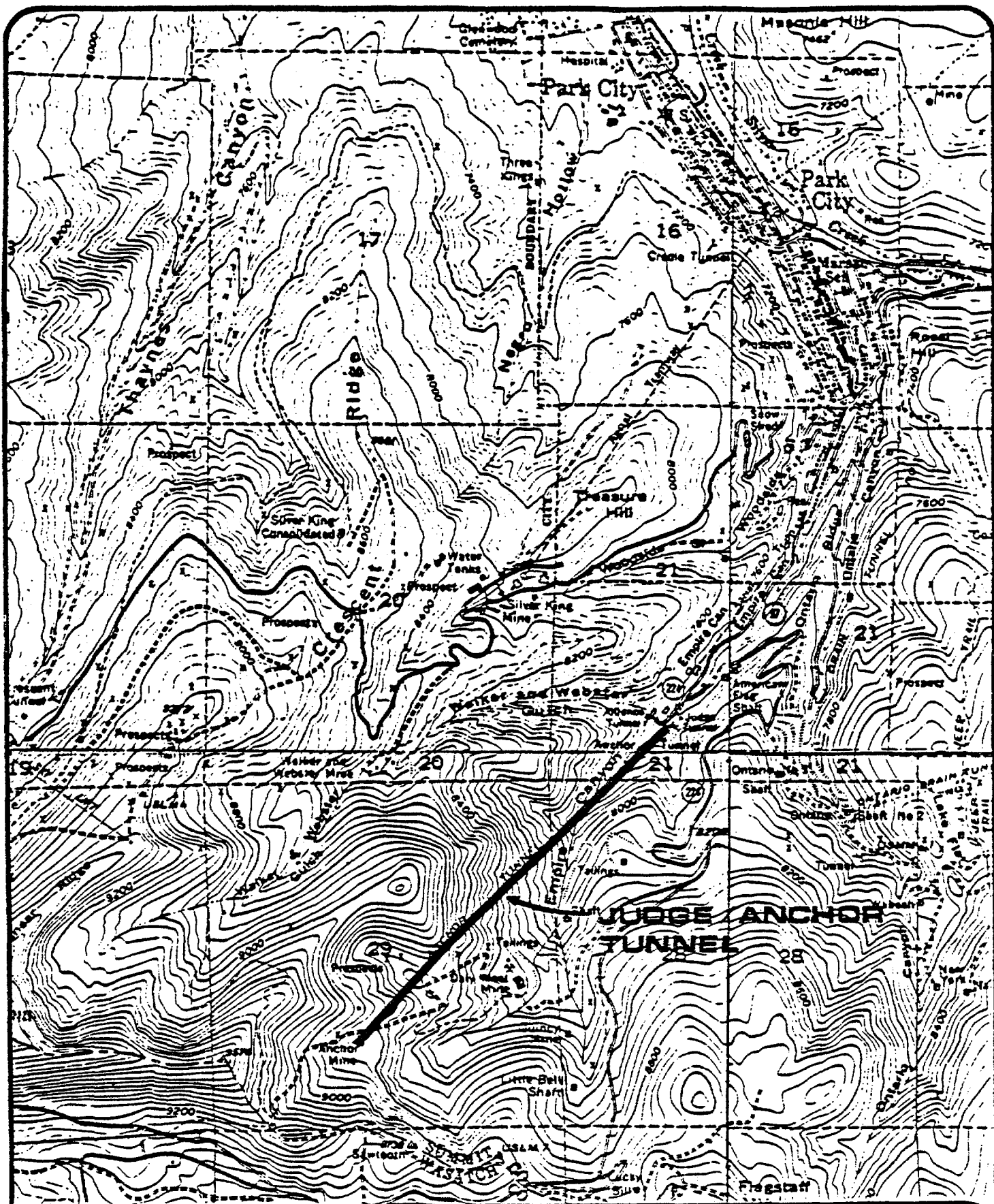


WATER RIGHTS
DIVERSION ALLOWANCE
 PARK CITY MUNICIPAL CORPORATION



FIGURE

1



JUDGE / ANCHOR TUNNEL LOCATION MAP

0 1000 2000



FIGURE

2

CHEMICAL ANALYSIS

Laboratory: Ford Chemical
Address: Salt Lake City
Sample No.: "Judge Tunnel"
Location: Judge Tunnel

Client: Park City Municipal Corp.
Project: Judge Tunnel Source
Date: March 8, 1974
Certificate
of Analysis: 74-763

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 100.0 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As | 0.00 | 0.05 | Barium as Ba | 0.00 | 1.0 |
| Bicarbonate as HCO ₃ | 121.2 | - | Boron as B | 0.00 | - |
| Cadmium as Cd | 0.000 | 0.010 | Calcium as Ca | 60.0 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | 0.00 | - |
| Chloride as Cl | 0.50 | 250 | Chromium as Cr | 0.00 | 0.05 |
| Chromium as Cr(tot) | - | - | Conductivity | 405.7 umhos/cm | |
| Copper as Cu | 0.01 | 1.0 | Fluoride as F | 0.39 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 184.0 | - | Hydroxide as OH | - | - |
| Iron as Fe (diss.) | 0.09 | - | Iron as Fe(Total) | 0.12 | 0.3 |
| Lead as Pb | 0.004 | 0.05 | Magnesium as Mg | 8.10 | - |
| Manganese as Mn | 0.00 | 0.05 | Mercury as Hg | 0.000 | 0.002 |
| Nickel as Ni | - | - | Nitrate as NO ₃ -N | 0.77 | 10.0 |
| Nitrite as NO ₂ -N | - | - | Phosphate PO ₄ -P | 0.20 | - |
| Potassium as K | 1.35 | - | Selenium as Se | 0.00 | 0.01 |
| Silica, SiO ₂ (diss.) | 0.60 | - | Silver as Ag | 0.001 | 0.05 |
| Sodium as Na | 1.80 | - | Sulfate as SO ₄ | 86.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 280.0 | 2000 |
| Turbidity | 0.30 | 5 NTU | Zinc as Zn | 0.05 | 5.0 |
| pH Units | 7.45 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.
(1) Depends on maximum daily air temperature.

**JUDGE / ANCHOR
TUNNEL 1974
CHEMICAL ANALYSIS**



FIGURE

3

CHEMICAL ANALYSIS

Laboratory: State Health

Client: Park City Municipal Corp.

Address: University of Utah Campus
Salt Lake City, Utah

Project: Judge Tunnel Source

Sample No.: "Judge Tunnel"

Date: May 11, 1981

Location: Judge Tunnel Water Box

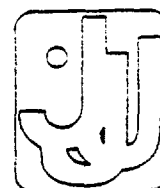
Certificate
of Analysis: C 812107

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------|-----------------|----------------|--------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO3 | 95.0 | - | Ammonia as NH3-N | - | - |
| Arsenic as As | 0.005 | 0.05 | Barium as Ba | < 0.05 | 1.0 |
| Bicarbonate as HCO3 | 116 | - | Boron as B | 0.065 | - |
| Cadmium as Cd | 0.001 | 0.010 | Calcium as Ca | 50 | - |
| Carbon Dioxide, CO2 | < 1 | - | Carbonate as CO3 | 0 | - |
| Chloride as Cl | < 2 | 250 | Chromium as Cr | < 0.005 | 0.05 |
| Chromium as Cr(tot) | < 0.005 | - | Conductivity | 320 umhos/cm | |
| Copper as Cu | 0.010 | 1.0 | Fluoride as F | 0.15 | 1.4-2.4(1) |
| Hardness as CaCO3 | 160 | - | Hydroxide as OH | 0.00 | - |
| Iron as Fe (diss.) | < 0.03 | | Iron as Fe(Total) | 0.11 | 0.3 |
| Lead as Pb | < 0.05 | 0.05 | Magnesium as Mg | 9 | - |
| Manganese as Mn | 0.015 | 0.05 | Mercury as Hg | 0.0001 | 0.002 |
| Nickel as Ni | < 0.01 | - | Nitrate as NO3-N | 0.15 | 10.0 |
| Nitrite as NO2-N | < 0.05 | - | Phosphate PO4-P | 0.05 | - |
| Potassium as K | 1.0 | - | Selenium as Se | < 0.001 | 0.01 |
| Silica, SiO2 (diss.) | 21.0 | - | Silver as Ag | < 0.002 | 0.05 |
| Sodium as Na | 4.0 | - | Sulfate as SO4 | 66.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 220 | 2000 |
| Turbidity | 0.6 | 5 NTU | Zinc as Zn | 0.315 | 5.0 |
| pH Units | 8.2 | 6.5-8.5 | | | |

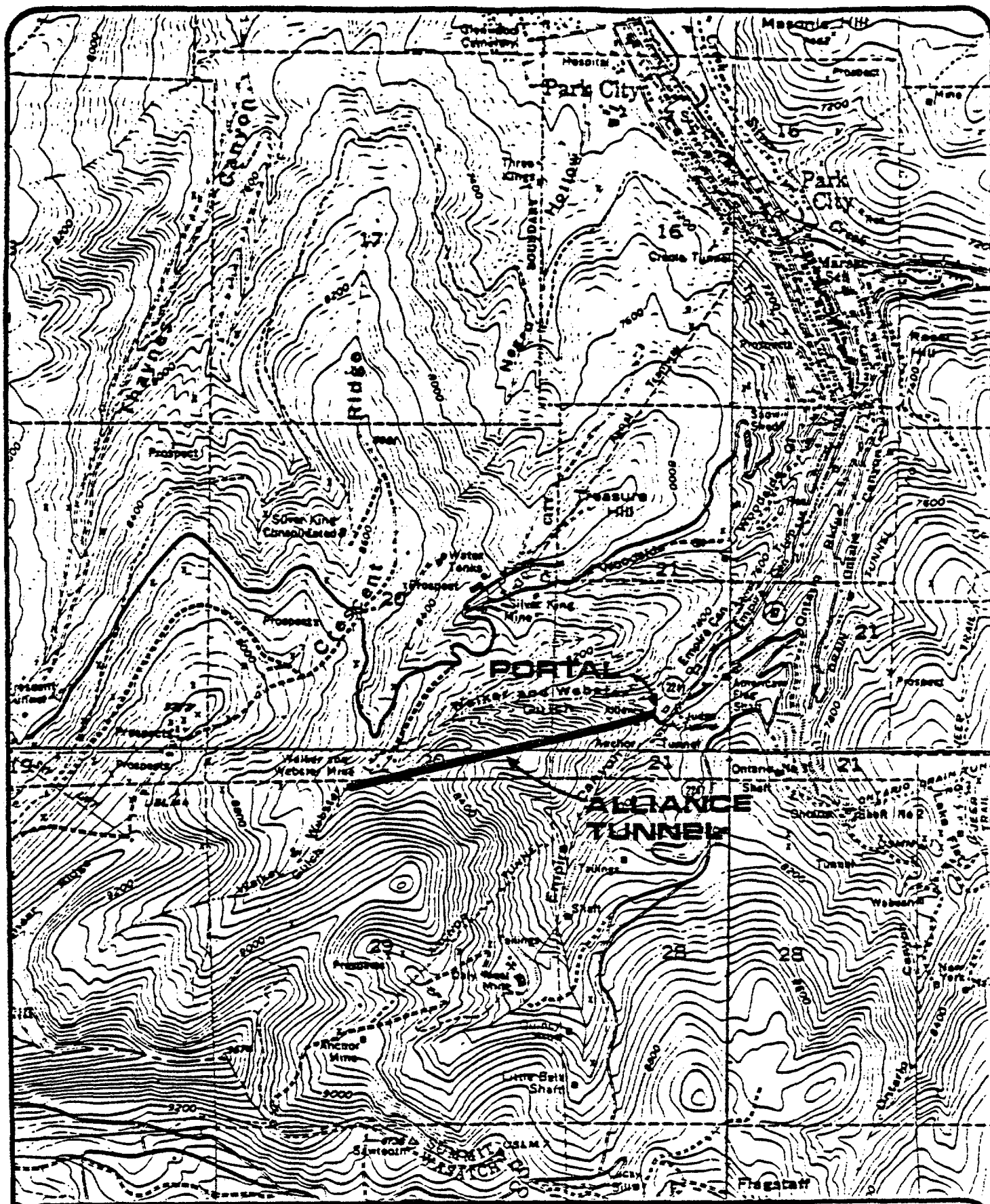
Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

**JUDGE / ANCHOR
TUNNEL 1981
CHEMICAL ANALYSIS**



**FIGURE
4**



ALLIANCE TUNNEL

LOCATION MAP 0 1000 2000

NORTH



FIGURE

5

CHEMICAL ANALYSIS

Laboratory: Ford Chemical

Client: Park City Municipal Corp.

Address: Salt Lake City

Project: Alliance Tunnel

Sample No.: "Alliance Tunnel"

Date: March 8, 1974

Location: Alliance Tunnel

Certificate
of Analysis: 74-764

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 140.0 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As | 0.00 | 0.05 | Barium as Ba | 0.00 | 1.0 |
| Bicarbonate as HCO ₃ | 169.6 | - | Boron as B | 0.00 | - |
| Cadmium as Cd | 0.000 | 0.010 | Calcium as Ca | 69.60 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | 0.00 | - |
| Chloride as Cl | 1.00 | 250 | Chromium as Cr | 0.00 | 0.05 |
| Chromium as Cr(tot) | - | - | Conductivity | 498.0 umhos/cm | |
| Copper as Cu | 0.03 | 1.0 | Fluoride as F | 0.36 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 226.0 | - | Hydroxide as OH | - | - |
| Iron as Fe (diss.) | 0.10 | - | Iron as Fe(Total) | 0.15 | 0.3 |
| Lead as Pb | 0.025 | 0.05 | Magnesium as Mg | 12.40 | - |
| Manganese as Mn | 0.00 | 0.05 | Mercury as Hg | 0.000 | 0.002 |
| Nickel as Ni | - | - | Nitrate as NO ₃ -N | 0.85 | 10.0 |
| Nitrite as NO ₂ -N | - | - | Phosphate PO ₄ -P | 0.26 | - |
| Potassium as K | 1.44 | - | Selenium as Se | 0.00 | 0.01 |
| Silica, SiO ₂ (diss.) | 0.47 | - | Silver as Ag | 0.000 | 0.05 |
| Sodium as Na | 2.0 | - | Sulfate as SO ₄ | 87.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 344.0 | 2000 |
| Turbidity | 0.17 | 5 NTU | Zinc as Zn | 0.17 | 5.0 |
| pH Units | 7.90 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.
(1) Depends on maximum daily air temperature.

ALLIANCE TUNNEL
1974
CHEMICAL ANALYSIS

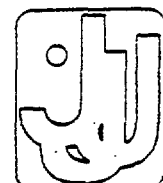


FIGURE
6

CHEMICAL ANALYSIS

Laboratory: State Health

Client: Park City Municipal Corp.

Address: University of Utah Campus
Salt Lake City, Utah

Project: Alliance Tunnel

Sample No.: "Alliance Tunnel"

Date: May 11, 1981

Location: Alliance Tunnel Water Box

Certificate
of Analysis: C 812106

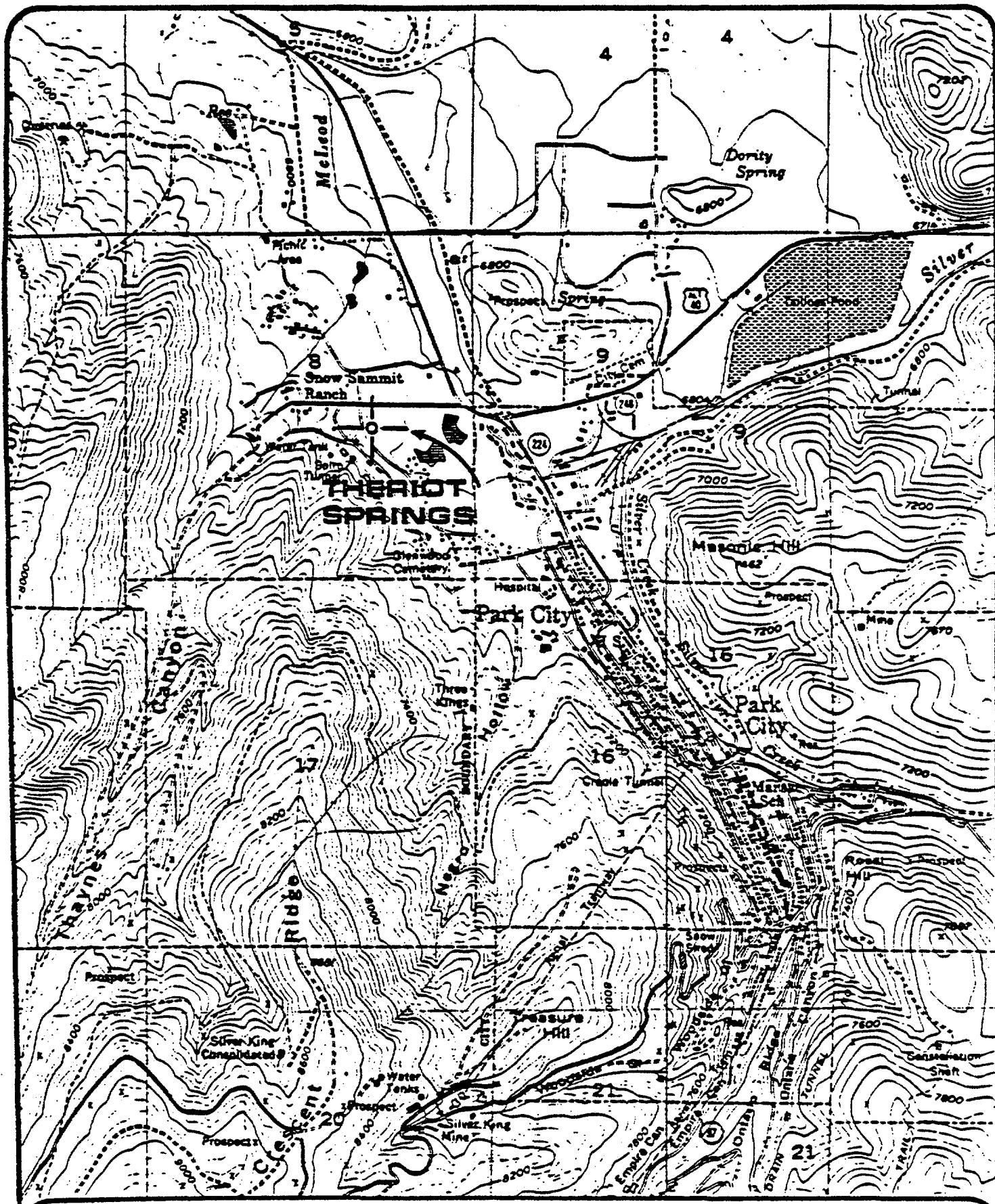
| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 153.0 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As | 0.003 | 0.05 | Barium as Ba | < 0.05 | 1.0 |
| Bicarbonate as HCO ₃ | 186.0 | - | Boron as B | 0.055 | - |
| Cadmium as Cd | 0.002 | 0.010 | Calcium as Ca | 90.0 | - |
| Carbon Dioxide, CO ₂ | 2.0 | - | Carbonate as CO ₃ | 0.0 | - |
| Chloride as Cl | 1.0 | 250 | Chromium as Cr | < 0.05 | 0.05 |
| Chromium as Cr(tot) | < 0.05 | - | Conductivity | 520 umhos/cm | |
| Copper as Cu | 0.015 | 1.0 | Fluoride as F | 0.15 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 282.0 | - | Hydroxide as OH | 0.00 | - |
| Iron as Fe (diss.) | < 0.03 | - | Iron as Fe(Total) | 0.05 | 0.3 |
| Lead as Pb | 14.0 | 0.05 | Magnesium as Mg | 14.0 | - |
| Manganese as Mn | 0.010 | 0.05 | Mercury as Hg | < 0.0001 | 0.002 |
| Nickel as Ni | < 0.010 | - | Nitrate as NO ₃ -N | < 0.05 | 10.0 |
| Nitrite as NO ₂ -N | < 0.05 | - | Phosphate PO ₄ -P | 0.04 | - |
| Potassium as K | 1.0 | - | Selenium as Se | < 0.001 | 0.01 |
| Silica, SiO ₂ (diss.) | 14.0 | - | Silver as Ag | < 0.002 | 0.05 |
| Sodium as Na | 8.0 | - | Sulfate as SO ₄ | 125.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 360.0 | 2000 |
| Turbidity | 0.3 | 5 NTU | Zinc as Zn | 0.425 | 5.0 |
| pH Units | 8.1 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.
(1) Depends on maximum daily air temperature.

ALLIANCE TUNNEL
1981
CHEMICAL ANALYSIS

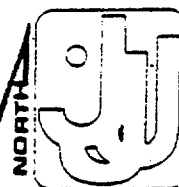


FIGURE
7



THERIOT SPRINGS

LOCATION MAP 0 1000 2000



FIGURE

8

CHEMICAL ANALYSIS

Laboratory: Utah State Health Department

Client: Park City Municipal Corp.

Address: University of Utah Campus
Salt Lake City, Utah

Project: Theriot Springs

Sample No.: "Theriot Springs"

Date: January 27, 1975

Location: Theriot Springs
Overflow Pipe

Certificate
of Analysis: 74-1993

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 154.0 | - | Ammonia as NH ₃ -N | 0.00 | - |
| Arsenic as As | 0.00 | 0.05 | Barium as Ba | 0.00 | 1.0 |
| Bicarbonate as HCO ₃ | 188.0 | - | Boron as B | 0.0 | - |
| Cadmium as Cd | 0.003 | 0.010 | Calcium as Ca | 58.0 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | 0.0 | - |
| Chloride as Cl | 3.0 | 250 | Chromium as Cr | 0.002 | 0.05 |
| Chromium as Cr(tot) | - | - | Conductivity | 410 umhos/cm | |
| Copper as Cu | 0.00 | 1.0 | Fluoride as F | 0.06 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 204.0 | - | Hydroxide as OH | 0.0 | - |
| Iron as Fe (diss.) | 0.01 | - | Iron as Fe(Total) | 0.01 | 0.3 |
| Lead as Pb | 0.006 | 0.05 | Magnesium as Mg | 14.0 | - |
| Manganese as Mn | 0.00 | 0.05 | Mercury as Hg | 0.0 | 0.002 |
| Nickel as Ni | 0.005 | - | Nitrate as NO ₃ -N | 0.35 | 10.0 |
| Nitrite as NO ₂ -N | 0.00 | - | Phosphate PO ₄ -P | 0.01 | - |
| Potassium as K | 1.0 | - | Selenium as Se | 0.00 | 0.01 |
| Silica, SiO ₂ (diss.) | 12.0 | - | Silver as Ag | 0.001 | 0.05 |
| Sodium as Na | 3.0 | - | Sulfate as SO ₄ | 61.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 258.0 | 2000 |
| Turbidity | 0.3 | 5 NTU | Zinc as Zn | 0.01 | 5.0 |
| pH Units | 6.5 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.
(1) Depends on maximum daily air temperature.

THERIOT SPRINGS
1975
CHEMICAL ANALYSIS

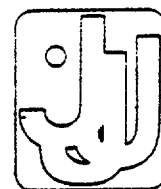


FIGURE
9

CHEMICAL ANALYSIS

Laboratory: State Health

Client: Park City Municipal Corp.

Address: University of Utah Campus
Salt Lake City, Utah

Project: Theriot Springs

Sample No.: "Theriot Springs"

Date: August 20, 1981

Location: Theriot Springs Spigot on Pump
Discharge Piping

Certificate
of Analysis: C 814960

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 107.0 | - | Ammonia as NH ₃ -N | < 0.01 | - |
| Arsenic as As | 0.002 | 0.05 | Barium as Ba | < 0.05 | 1.0 |
| Bicarbonate as HCO ₃ | 130.0 | - | Boron as B | < 0.05 | - |
| Cadmium as Cd | < 0.001 | 0.010 | Calcium as Ca | 38.0 | - |
| Carbon Dioxide, CO ₂ | 2.0 | - | Carbonate as CO ₃ | 0.0 | - |
| Chloride as Cl | 2.0 | 250 | Chromium as Cr | < 0.005 | 0.05 |
| Chromium as Cr(tot) | < 0.005 | - | Conductivity | 300 umhos/cm | |
| Copper as Cu | < 0.010 | 1.0 | Fluoride as F | 0.10 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 152.0 | - | Hydroxide as OH | 0.00 | - |
| Iron as Fe (diss.) | - | - | Iron as Fe(Total) | 0.05 | 0.3 |
| Lead as Pb | < 0.005 | 0.05 | Magnesium as Mg | 14.0 | - |
| Manganese as Mn | < 0.010 | 0.05 | Mercury as Hg | < 0.0001 | 0.002 |
| Nickel as Ni | < 0.010 | - | Nitrate as NO ₃ -N | 0.50 | 10.0 |
| Nitrite as NO ₂ -N | < 0.05 | - | Phosphate PO ₄ -P | 0.02 | - |
| Potassium as K | 1.0 | - | Selenium as Se | < 0.001 | 0.01 |
| Silica, SiO ₂ (diss.) | 16.0 | - | Silver as Ag | < 0.002 | 0.05 |
| Sodium as Na | 4.0 | - | Sulfate as SO ₄ | 49.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 194.0 | 2000 |
| Turbidity | 0.2 | 5 NTU | Zinc as Zn | 85.0 | 5.0 |
| pH Units | 8.0 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

THERIOT SPRINGS
1981
CHEMICAL ANALYSIS



FIGURE
10

BACTERIOLOGICAL ANALYSIS

Laboratory: Utah State Health

Client: Park City Municipal Corp.

Address: Salt Lake City, Utah

Project: Theriot Springs

Sample No.: "Theriot Springs"

Date: August 20, 1981

Location: Theriot Springs

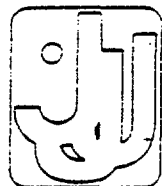
Certificate
of Analysis: 04492

Results: Negative (zero count)

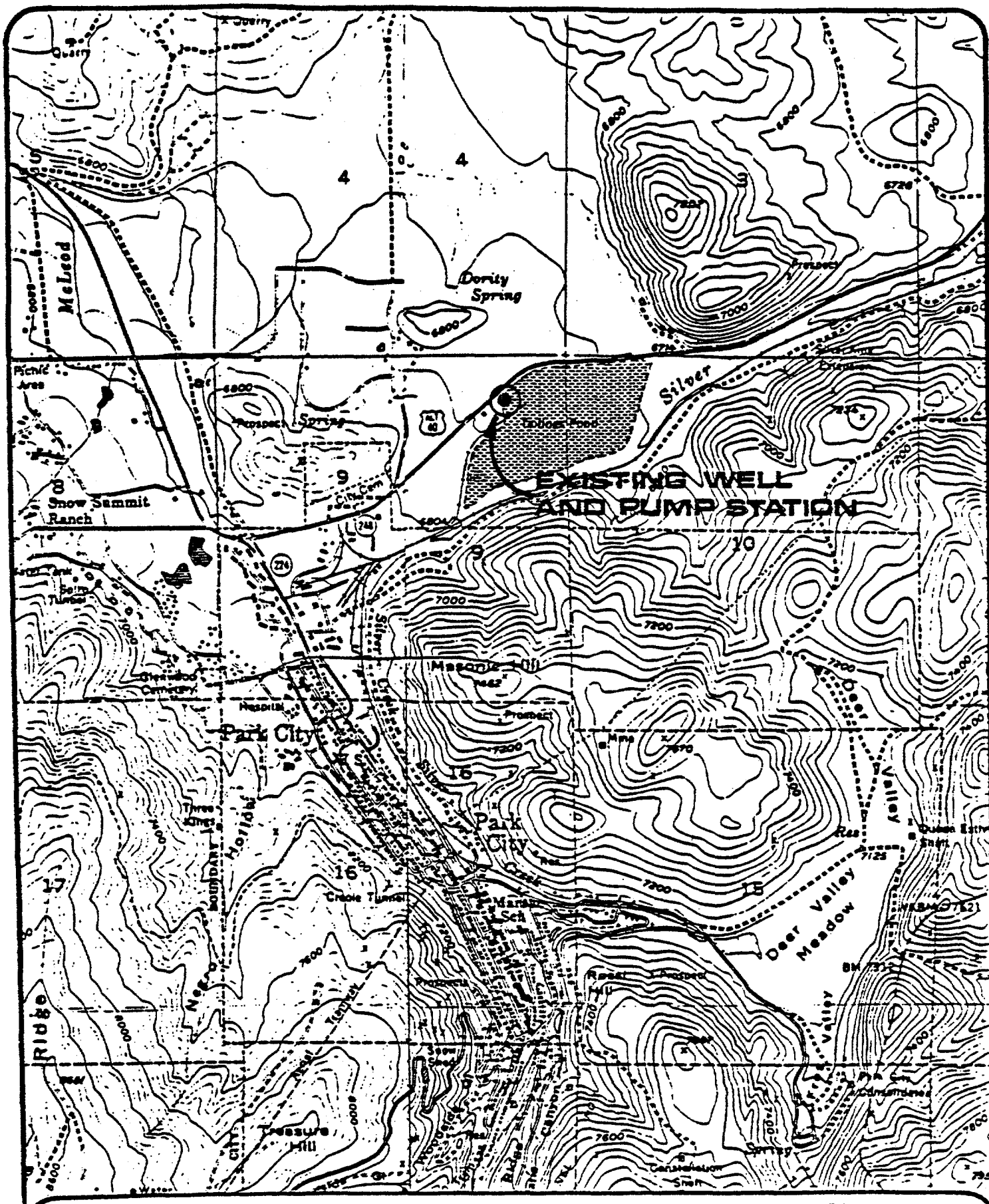
Comments: Sample taken after treatment.

NOTE: This source water is only considered acceptable for human consumption if it has been treated. The raw spring water, prior to treatment, will not be considered acceptable.

**THERIOT SPRINGS
1981
BACTERIOLOGICAL ANALYSIS**



**FIGURE
11**



PACIFIC BRIDGE WELL LOCATION MAP

0 1000 2000

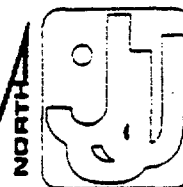


FIGURE
12

Reported: _____
 Reported: S. E. _____ T. B. _____
 Reported: _____
 Cause: _____

REPORT OF WELL DRILLER
STATE OF UTAH

Applicant No. _____
 Date No. _____
 Signature No. _____

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:
Name Pacific Bridge Company
Address Park City, Utah

(2) LOCATION OF WELL:
County SUtter Ground Water Basin _____

[illegible]

(3) NATURE OF WORK (check): New Work ☒
 Replacement Work ☐ Rebuilding ☐ Repair ☐ Alteration ☐
 Is construction, assembly, alteration and maintenance?

(4) NATURE OF USE (check):

| | | | |
|--|-------------------------------------|-----------------------------------|-----------------------------------|
| Domestic <input checked="" type="checkbox"/> | Industrial <input type="checkbox"/> | Hospital <input type="checkbox"/> | Swimming <input type="checkbox"/> |
| Education <input type="checkbox"/> | Other <input type="checkbox"/> | Other <input type="checkbox"/> | Ten Wall <input type="checkbox"/> |

(5) TYPE OF CONSTRUCTION (check):

| | | | | | |
|----------|--------------------------|--------|--------------------------|---------|--------------------------|
| Assembly | <input type="checkbox"/> | Box | <input type="checkbox"/> | Jointed | <input type="checkbox"/> |
| Circle | <input type="checkbox"/> | Recess | <input type="checkbox"/> | Recess | <input type="checkbox"/> |

(8) CASING SCHEDULE: Thermal ☐ Welded ☐
 16" - Work. diam. 0 - 100 - 5/16
 12" - Work. diam. 0 - 300 - std
 10" - Work. diam. 300 - 398 -
 6" - 398 - 446 -
 4" - 446 -

(7) PERFORATIONS: Perforated: Yes ☒ No ☐

Type of perforation used _____

Size of perforation: _____ inches by _____ inches

| Perforation | Size | Quantity | Weight |
|-------------|------|----------|--------|
| Perforation | 300 | 198 | |
| Perforation | 198 | 446 | |
| Perforation | Size | Quantity | Weight |
| Perforation | Size | Quantity | Weight |
| Perforation | Size | Quantity | Weight |
| Perforation | Size | Quantity | Weight |

(8) SCREENS: Will movie be shown? Yes ☐ No ☐
 Distributor's Name _____
 Title _____ Serial No. _____
 Date _____ Film Title _____ Film Length _____
 Show _____ Film Title _____ Film Length _____

(9) CONSTRUCTION:

Was wall ground surface? Yes ☐ No ☐ Size of ground: _____

Ground placed from: _____ Amt in _____

Was a surface coat placed? Yes ☐ No ☐

To what depth: _____

Material used to coat: _____

Did any cracks contain verminous matter? Yes ☐ No ☐

Type of water: _____ Depth of water: _____

Presence of surface water on: _____

| | | | | |
|-----------------------------|-----|--------------------------|----|--------------------------|
| Was system money worth? | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| Was it convenient to start? | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |

(10) WATER LEVELS:

LOG RECEIVED: (11) FLOWING WELL:

| | | |
|---|-------|--------------------------|
| Completed by (name): | Value | <input type="checkbox"/> |
| Cap <input type="checkbox"/> Plug <input type="checkbox"/> No Guard | | <input type="checkbox"/> |
| Does well back around casing? | Yes | <input type="checkbox"/> |
| | No | <input type="checkbox"/> |

(12) WELL TESTS: Driveway in the basement is built the same kind as in-
vested better main floor.

Was a pump out made? Yes ☒ No ☐ by whom: Peterson Bros. SLC

Total: 280 gal./min. with 290 feet driveway after _____ hours

_____ gal./min. with _____ feet driveway after _____ hours

_____ gal./min. with _____ feet driveway after _____ hours

_____ gal./min. with _____ feet driveway after _____ hours

APPROX. How _____ a.s.d. No. 9-22-48

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒

(13) WELL LOG: _____ Diameter of well _____ 6 _____ inches
 Depth drilled _____ 446 _____ feet. Depth of completed well _____ 446 _____ feet.

NOTE: Place an "X" in the column or combination of columns desired to emphasize the material or combination of materials encountered in each depth interval. Under REMARKS make any descriptive notes up to 100 characters of length and include well, section, etc., of material if applicable. Insert the well number in the space.

| DEPTH | | MATERIAL | | | | | | | | | | REMARKS |
|-------|----|----------|------|--------|--------|--------|--------|--------|--------|--------|--------|------------------------------|
| Feet | ft | Gravel | Sand | Gravel | Gravel | Gravel | Gravel | Gravel | Gravel | Gravel | Gravel | |
| 0 | 5 | | X | X | | | | | | | | sand and gravel |
| 5 | 9 | | X | | | | | | | | | solid sand |
| 9 | 35 | X | | X | | | | | | | | gravel and clay |
| 35 | 66 | X | | X | | | | | | | | gravel and clay |
| 66 | 70 | | | X | | | | | | | | loose gravel, some water |
| 70 | 65 | X | | X | | | | | | | | gravel and clay |
| 65 | 15 | X | | X | | | | X | | | | quartzite clay, 1 |
| 15 | 20 | X | | | | | | | | | | clay |
| 20 | 10 | X | | X | | | | | | | | clay and gravel |
| 10 | 15 | | | X | | | | | | | | loose gravel w/ water |
| 15 | 25 | X | | | | | | X | | | | quartzite lime, clay |
| 25 | 95 | | | | | | | X | | | | red shale |
| 95 | 15 | | | | | | | X | | | | red shale, some water |
| 15 | 60 | | | X | | | | X | | | | red shale, quartzite, gravel |
| 60 | 65 | | | | | | | X | | | | hard lime, quartzite, shale |
| 65 | 25 | | | X | | | | X | | | | red shale, quartzite, shale |
| 25 | 32 | | | X | | | | X | | | | red shale, sulfur odor |
| 32 | 45 | | | X | | | | X | | | | red shale, quartzite, gravel |
| 45 | 46 | | | | | | | X | | | | very hard bedrock |

Work started July 26 n48 c Sept. 19 n48

(14) PUMP:

Manufacturer's Name _____

Type: _____ H. P. _____

Depth to pump or level _____ feet

Well Driller's Statement:

This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.

Name LARRY W. DALTON

(Printer, State, or corporation) (Type or print)

Address _____

(Signed) _____

(Well Driller)

I license No. _____ Date _____ 19 _____

PACIFIC BRIDGE WELL WELL DRILLERS REPORT



FIGURE
13

CHEMICAL ANALYSIS

Laboratory: Ford Chemical

Client: Park City Municipal Corp.

Address: Salt Lake City, Utah

Project: Pacific Bridge Well

Sample No.: "Pacific Bridge Well"

Date: April 4, 1974

Location: Pacific Bridge Well
Park City, Utah

Certificate
of Analysis: 74-1213

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 120.0 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As | 0.00 | 0.05 | Barium as Ba | 0.00 | 1.0 |
| Bicarbonate as HCO ₃ | 145.4 | - | Boron as B | 0.00 | - |
| Cadmium as Cd | 0.000 | 0.010 | Calcium as Ca | 52.0 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | 0.00 | - |
| Chloride as Cl | 22.0 | 250 | Chromium as Cr | 0.00 | 0.05 |
| Chromium as Cr(tot) | - | - | Conductivity | 531.0 umhos/cm | |
| Copper as Cu | 0.05 | 1.0 | Fluoride as F | 0.38 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 240.0 | - | Hydroxide as OH | - | - |
| Iron as Fe (diss.) | 0.10 | | Iron as Fe(Total) | 0.12 | 0.3 |
| Lead as Pb | 0.00 | 0.05 | Magnesium as Mg | 26.4 | - |
| Manganese as Mn | 0.00 | 0.05 | Mercury as Hg | 0.000 | 0.002 |
| Nickel as Ni | - | - | Nitrate as NO ₃ -N | 4.60 | 10.0 |
| Nitrite as NO ₂ -N | - | - | Phosphate PO ₄ -P | 0.25 | - |
| Potassium as K | 1.10 | - | Selenium as Se | 0.00 | 0.01 |
| Silica, SiO ₂ (diss.) | 0.20 | - | Silver as Ag | 0.000 | 0.05 |
| Sodium as Na | 11.5 | - | Sulfate as SO ₄ | 110.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 367.0 | 2000 |
| Turbidity | 0.05 | 5 NTU | Zinc as Zn | 0.19 | 5.0 |
| pH Units | 7.4 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

**PACIFIC BRIDGE
WELL 1974
CHEMICAL ANALYSIS**



FIGURE

14

CHEMICAL ANALYSIS

Laboratory: Utah State Health Department

Client: Park City Municipal Corp.

Address: University of Utah
Salt Lake City, Utah

Project: Pacific Bridge Well

Sample No.: "Pacific Bridge Well"

Date: September 18, 1980

Location: Pacific Bridge Well
Park City, Utah

Certificate
of Analysis: C 804194

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 103.0 | - | Ammonia as NH ₃ -N | < 0.1 | -- |
| Arsenic as As | < 0.001 | 0.05 | Barium as Ba | < 0.05 | 1.0 |
| Bicarbonate as HCO ₃ | 126.0 | - | Boron as B | < 0.05 | - |
| Cadmium as Cd | < 0.001 | 0.010 | Calcium as Ca | 66.0 | - |
| Carbon Dioxide, CO ₂ | 2.0 | - | Carbonate as CO ₃ | 0.0 | - |
| Chloride as Cl | 52.0 | 250 | Chromium as Cr | < 0.005 | 0.05 |
| Chromium as Cr(tot) | < 0.005 | - | Conductivity | 605 umhos/cm | |
| Copper as Cu | < 0.10 | 1.0 | Fluoride as F | 0.10 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 272.0 | - | Hydroxide as OH | 0.00 | - |
| Iron as Fe (diss.) | - | - | Iron as Fe(Total) | 1.70 | 0.3 |
| Lead as Pb | < 0.10 | 0.05 | Magnesium as Mg | 26.0 | - |
| Manganese as Mn | 0.030 | 0.05 | Mercury as Hg | 0.0002 | 0.002 |
| Nickel as Ni | < 0.010 | - | Nitrate as NO ₃ -N | 4.15 | 10.0 |
| Nitrite as NO ₂ -N | < 0.05 | - | Phosphate PO ₄ -P | < 0.03 | - |
| Potassium as K | 1.0 | - | Selenium as Se | < 0.001 | 0.01 |
| Silica, SiO ₂ (diss.) | 17.0 | - | Silver as Ag | < 0.002 | 0.05 |
| Sodium as Na | 18.0 | - | Sulfate as SO ₄ | 1061 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 356 | 2000 |
| Turbidity* | 8.0 | 5 NTU | Zinc as Zn* | 40.0 | 5.0 |
| pH Units | 8.1 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

*Results exceed secondary contaminant levels, but are not considered harmful.
Staining of hardward and laundry could occur.

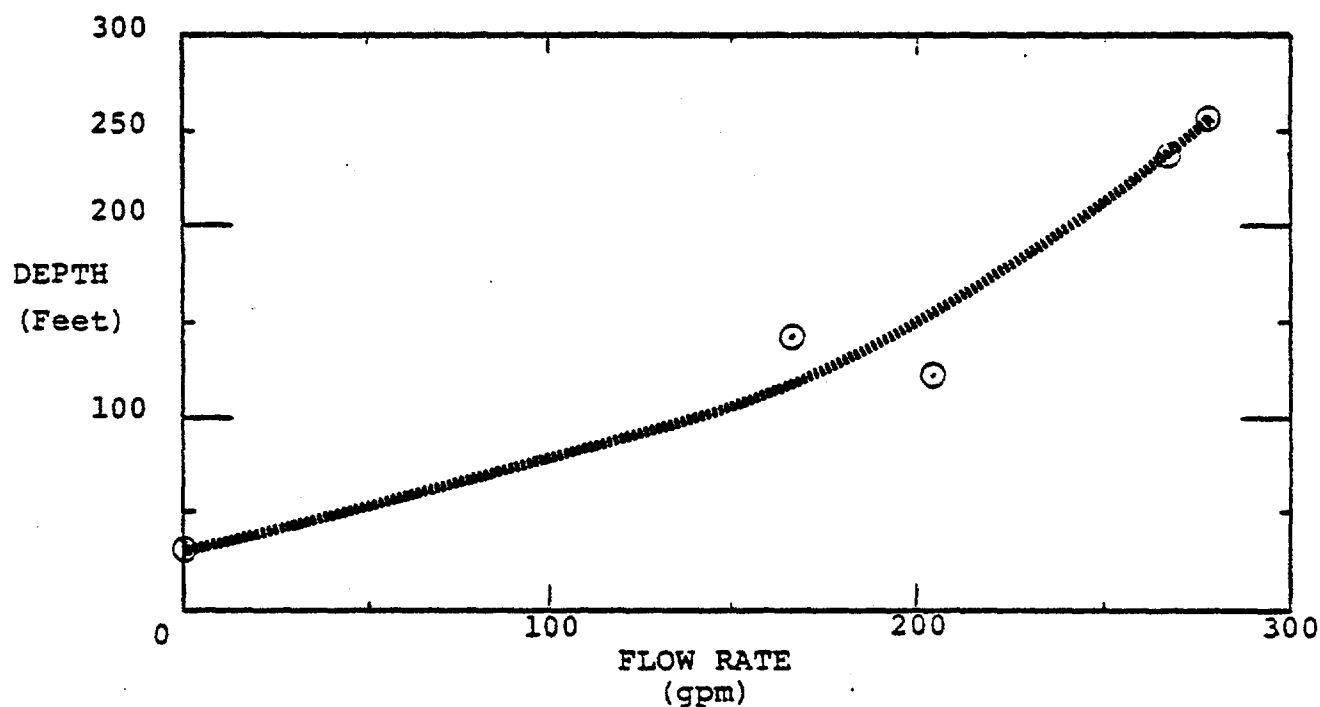
**PACIFIC BRIDGE
WELL 1980
CHEMICAL ANALYSIS**



**FIGURE
15**

PACIFIC BRIDGE WELL TEST NO. 2 - 300 FOOT SETTING

| Time | Depth to Water Level (Feet) | Flow Rate (gpm) |
|-------|-----------------------------------|--------------------|
| 09:00 | 30.0 | 0 |
| 09:30 | 121.5 | 205 |
| 10:00 | 139.0 | 192 |
| 10:30 | 142.0 | 183 |
| 11:00 | 145.0 | 178 |
| 11:30 | 146.0 | 172 |
| 12:00 | 147.5 | 167 |
| 12:30 | 147.5 | 167 |
| 13:00 | 147.5 | 167 |
| 13:30 | 147.5 | 167 |
| 14:00 | 147.5 | 167 |
| 14:30 | 237.5 | 267 |
| 15:00 | 255.0 | 277 |
| 15:30 | 256.0 | 266 |
| 16:00 | 259.0 | 263 |
| 16:30 | 259.0 | 263 |
| 17:00 | 259.0 | 263 |



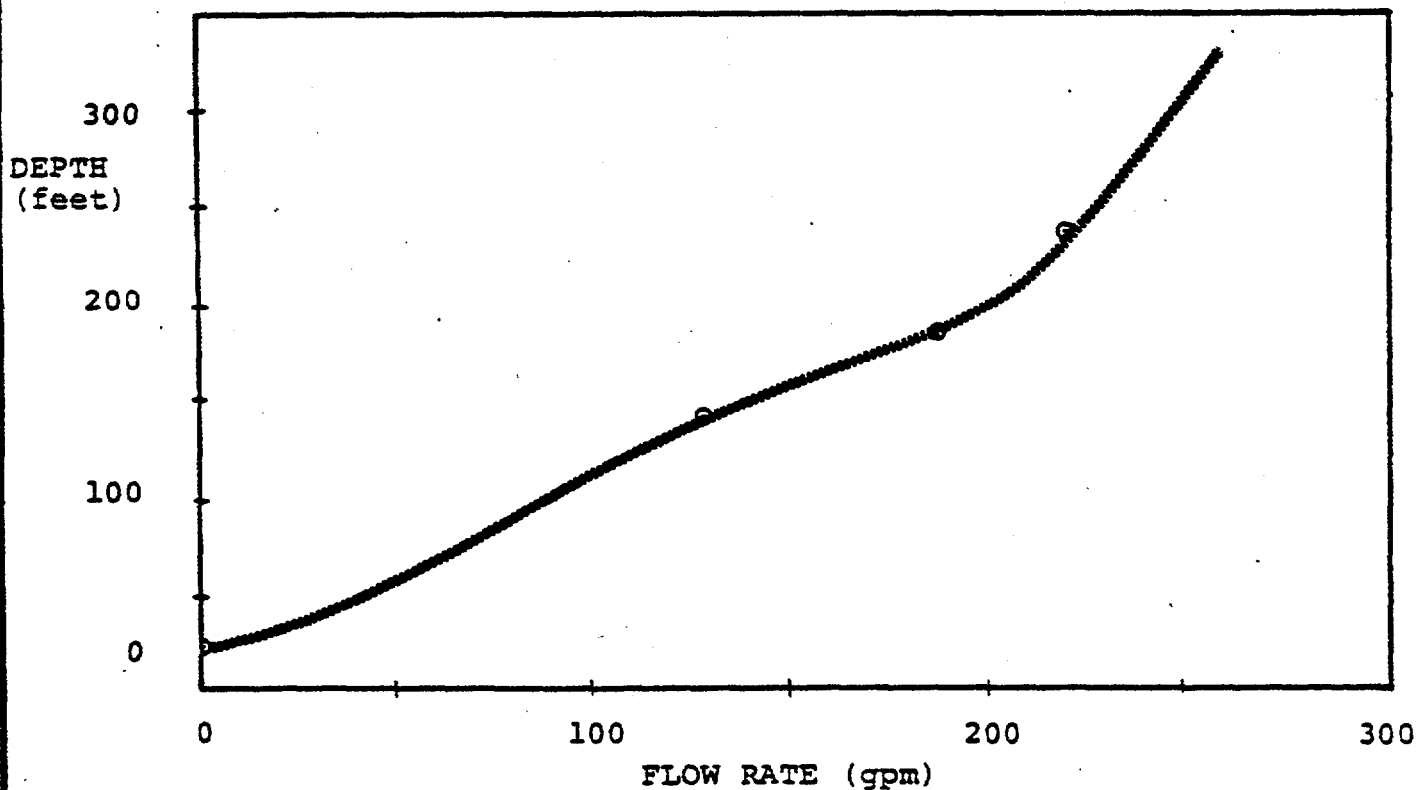
**PACIFIC BRIDGE
WELL 1977
PUMP DRAWDOWN CURVE**



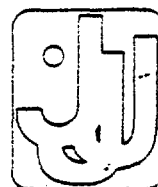
**FIGURE
16**

PACIFIC BRIDGE WELL TEST NO. 2 - 350 FOOT SETTING
July 13, 1982

| Time | Depth to Water Level (Feet) | Flow Rate (gpm) |
|-------|-----------------------------------|--------------------|
| 08:00 | 20.0 | 0 |
| 08:30 | 237.0 | 226 |
| 09:00 | 276.0 | 226 |
| 09:30 | 292.0 | 226 |
| 10:00 | 303.0 | 226 |
| 10:30 | 311.0 | 224 |
| 11:00 | 299.0 | 212 |
| 11:30 | 290.0 | 210 |
| 12:00 | 292.0 | 210 |
| 12:30 | 292.0 | 207 |
| 13:00 | 293.0 | 207 |
| 14:00 | - | - |
| 15:00 | 294.0 | 207 |
| 16:00 | 294.0 | 207 |
| 17:00 | 315.0 | 214 |
| 18:00 | 314.0 | 212 |
| 19:00 | 315.0 | 212 |



**PACIFIC BRIDGE
WELL 1982
PUMP DRAWDOWN CURVE**



**FIGURE
17**

CHEMICAL ANALYSIS

Laboratory: Ford Chemical

Client: Park City Municipal Corp.

Address: Salt Lake City, Utah

Project: Spiro Tunnel

Sample No.: "Park City - Source "West Drift"

Date: March 2, 1971

Location: Spiro Tunnel, West Drift

Certificate
of Analysis: 71-427

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 150.0 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As | 0.00 | 0.05 | Barium as Ba | 0.05 | 1.0 |
| Bicarbonate as HCO ₃ | 181.0 | - | Boron as B | 0.10 | - |
| Cadmium as Cd | 0.00 | 0.010 | Calcium as Ca | 120.0 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | 2.50 | - |
| Chloride as Cl | 12.0 | 250 | Chromium as Cr | 0.00 | 0.05 |
| Chromium as Cr(tot) | 0.00 | - | Conductivity | 990.6 umhos/cm | |
| Copper as Cu | 0.06 | 1.0 | Fluoride as F | 0.76 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 471.0 | - | Hydroxide as OH | - | - |
| Iron as Fe (diss.) | 0.28 | - | Iron as Fe(Total) | 0.31 | 0.3 |
| Lead as Pb | 0.00 | 0.05 | Magnesium as Mg | 41.7 | - |
| Manganese as Mn | 0.00 | 0.05 | Mercury as Hg | 0.00 | 0.002 |
| Nickel as Ni | - | - | Nitrate as NO ₃ -N | 1.20 | 10.0 |
| Nitrite as NO ₂ -N | - | - | Phosphate PO ₄ -P | 0.88 | - |
| Potassium as K | 2.00 | - | Selenium as Se | 0.00 | 0.01 |
| Silica, SiO ₂ (diss.) | 0.00 | - | Silver as Ag | 0.01 | 0.05 |
| Sodium as Na | 3.00 | - | Sulfate as SO ₄ | 275.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 634.0 | 2000 |
| Turbidity | - | 5 NTU | Zinc as Zn | 0.04 | 5.0 |
| pH Units | 7.10 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

SPIRO TUNNEL
1971
CHEMICAL ANALYSIS



FIGURE
18

CHEMICAL ANALYSIS

Laboratory: Ford Chemical

Address: Salt Lake City, Utah

Sample No.: "W.E.S. #1"

Location: Spiro Tunnel, West Drift

Client: Park City Municipal Corp.

Project: Spiro Tunnel

Date: February 15, 1974

Certificate
of Analysis: 74-676

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 128.0 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As | 0.00 | 0.05 | Barium as Ba | 0.01 | 1.0 |
| Bicarbonate as HCO ₃ | 155.0 | - | Boron as B | 0.00 | - |
| Cadmium as Cd | 0.000 | 0.010 | Calcium as Ca | 104.0 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | 0.00 | - |
| Chloride as Cl | 2.0 | 250 | Chromium as Cr | 0.00 | 0.05 |
| Chromium as Cr(tot) | - | - | Conductivity | 947.0 umhos/cm | |
| Copper as Cu | 0.00 | 1.0 | Fluoride as F | 0.46 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 410.0 | - | Hydroxide as OH | - | - |
| Iron as Fe (diss.) | 0.20 | - | Iron as Fe(Total) | 0.25 | 0.3 |
| Lead as Pb | 0.001 | 0.05 | Magnesium as Mg | 36.0 | - |
| Manganese as Mn | 0.00 | 0.05 | Mercury as Hg | 0.00 | 0.002 |
| Nickel as Ni | - | - | Nitrate as NO ₃ -N | 0.99 | 10.0 |
| Nitrite as NO ₂ -N | - | - | Phosphate PO ₄ -P | 0.10 | - |
| Potassium as K | 2.36 | - | Selenium as Se | 0.00 | 0.01 |
| Silica, SiO ₂ (diss.) | 0.48 | - | Silver as Ag | 0.003 | 0.05 |
| Sodium as Na | 27.60 | - | Sulfate as SO ₄ | 327.50 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 654.0 | 2000 |
| Turbidity | 0.66 | 5 NTU | Zinc as Zn | 0.03 | 5.0 |
| pH Units | 7.55 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.
(1) Depends on maximum daily air temperature.

SPIRO TUNNEL
1974
CHEMICAL ANALYSIS



FIGURE
19

CHEMICAL ANALYSIS

Laboratory: Ford Chemical

Client: Park City Municipal Corp.

Address: Salt Lake City, Utah

Project: Spiro Tunnel

Sample No.: West Drift

Date: February 22, 1979

Location: Spiro Tunnel,
13,650 Feet From Portal

Certificate
of Analysis: 79-1037

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 144.0 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As* | 0.54 | 0.05 | Barium as Ba | 0.01 | 1.0 |
| Bicarbonate as HCO ₃ | 175.68 | - | Boron as B | 0.07 | - |
| Cadmium as Cd | < 0.001 | 0.010 | Calcium as Ca | 110.4 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | < 0.01 | - |
| Chloride as Cl | < 0.01 | 250 | Chromium as Cr | < 0.001 | 0.05 |
| Chromium as Cr(tot) | < 0.001 | - | Conductivity | 825 umhos/cm | |
| Copper as Cu | 0.012 | 1.0 | Fluoride as F | 0.16 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 444.0 | - | Hydroxide as OH | - | - |
| Iron as Fe (diss.) | 0.202 | - | Iron as Fe(Total) | 0.262 | 0.3 |
| Lead as Pb | < 0.001 | 0.05 | Magnesium as Mg | 40.32 | - |
| Manganese as Mn | 0.025 | 0.05 | Mercury as Hg | < 0.0002 | 0.002 |
| Nickel as Ni | < 0.001 | - | Nitrate as NO ₃ -N | 0.20 | 10.0 |
| Nitrite as NO ₂ -N | < 0.01 | - | Phosphate PO ₄ -P | - | - |
| Potassium as K | 1.779 | - | Selenium as Se | < 0.001 | 0.01 |
| Silica, SiO ₂ (diss.) | 14.50 | - | Silver as Ag | < 0.001 | 0.05 |
| Sodium as Na | 5.12 | - | Sulfate as SO ₄ | 292.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 538.0 | 2000 |
| Turbidity | 0.58 | 5 NTU | Zinc as Zn | 0.058 | 5.0 |
| pH Units | 7.68 | 6.5-8.5 | Surfactants MBAS | < 0.05 | - |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81. Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

*Exceeds "Primary Drinking Water Standards," Rev. 5-81, Utah Board of Health.

SPIRO TUNNEL
1979
CHEMICAL ANALYSIS



FIGURE
20

CHEMICAL ANALYSIS

Laboratory: Ford Chemical Laboratory Inc. Client: Bush & Gudgeall

Address: 40 West Louise Avenue
Salt Lake City, Utah

Project: Thayne Shaft - Park City
near Spiro Tunnel

Sample No.: "Thayne Shaft"
Sample taken March 20, 1974

Date: March 25, 1974

Location: Thayne Shaft - Park City

Certificate
of Analysis: 74-969

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 60.0 | - | Aluminium as Al | 0.00 | - |
| Arsenic as As | 0.00 | 0.05 | Barium as Ba | 0.00 | 1.0 |
| Bicarbonate as HCO ₃ | 72.70 | - | Boron as B | 0.00 | - |
| Cadmium as Cd | 0.000 | 0.010 | Calcium as Ca | 59.20 | - |
| Cyanide as CN | 0.00 | - | Carbonate as CO ₃ | 0.00 | - |
| Chloride as Cl | 0.50 | 250 | Chromium as Cr | 0.00 | 0.05 |
| Chromium as Cr(Hex) | 0.00 | - | Conductivity | 449.1 umhos/cm | |
| Copper as Cu | 0.00 | 1.0 | Fluoride as F | 0.74 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 210.0 | - | Hydroxide as OH | - | - |
| Iron as Fe (filt.) | 0.10 | - | Iron as Fe(Total) | 0.12 | 0.3 |
| Lead as Pb | 0.000 | 0.05 | Magnesium as Mg | 14.80 | - |
| Manganese as Mn | 0.00 | 0.05 | Mercury as Hg | 0.000 | 0.002 |
| Nickel as Ni | - | - | Nitrate as NO ₃ -N | 0.58 | 10.0 |
| Nitrite as NO ₂ -N | - | - | Phosphate PO ₄ | 0.33 | - |
| Potassium as K | 2.40 | - | Selenium as Se | 0.00 | 0.01 |
| Silica, SiO ₂ (diss.) | 0.55 | - | Silver as Ag | 0.000 | 0.05 |
| Sodium as Na | 5.40 | - | Sulfate as SO ₄ | 154.0 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 310.0 | 2000 |
| Turbidity | 0.12 JTU | 5 NTU | Zinc as Zn | 0.13 | 5.0 |
| pH Units | 7.50 | 6.5-8.5 | | | |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

**THAYNES SHAFT
1974
CHEMICAL ANALYSIS**



**FIGURE
21**

CHEMICAL ANALYSIS

Laboratory: Ford Chemical

Client: Park City Municipal Corp.

Address: Salt Lake City, Utah

Project: Park Meadows Well

Sample No.: "Park Meadows Well"

Date: October 3, 1976

Location: Park Meadows Well,
Well Discharge Pipe

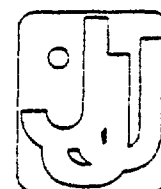
Certificate
of Analysis: Chemical - 79-007461
Bacteriological - 79-015068

| <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> | <u>Chemical:</u> | <u>Results:</u> | <u>Limits:</u> |
|----------------------------------|-----------------|----------------|-------------------------------|-----------------|----------------|
| | mg/l | mg/l | | mg/l | mg/l |
| Alkalinity as CaCO ₃ | 188.00 | - | Ammonia as NH ₃ -N | - | - |
| Arsenic as As | < 0.001 | 0.05 | Barium as Ba | 0.220 | 1.0 |
| Bicarbonate as HCO ₃ | 229.36 | - | Boron as B | 0.020 | - |
| Cadmium as Cd | < 0.001 | 0.010 | Calcium as Ca | 123.20 | - |
| Carbon Dioxide, CO ₂ | - | - | Carbonate as CO ₃ | < 0.01 | - |
| Chloride as Cl | 18.0 | 250 | Chromium as Cr | 0.001 | 0.05 |
| Chromium as Cr(tot) | < 0.001 | - | Conductivity | 670 umhos/cm | |
| Copper as Cu | 0.056 | 1.0 | Fluoride as F | 0.14 | 1.4-2.4(1) |
| Hardness as CaCO ₃ | 340 | - | Hydroxide as OH | - | - |
| Iron as Fe (diss.) | 0.065 | - | Iron as Fe(Total) | 0.250 | 0.3 |
| Lead as Pb | < 0.001 | 0.05 | Magnesium as Mg | 7.68 | - |
| Manganese as Mn | 0.015 | 0.05 | Mercury as Hg | < 0.0002 | 0.002 |
| Nickel as Ni | < 0.001 | - | Nitrate as NO ₃ -N | 1.30 | 10.0 |
| Nitrite as NO ₂ -N | - | - | Phosphate PO ₄ -P | - | - |
| Potassium as K | 3.500 | - | Selenium as Se | < 0.001 | 0.01 |
| Silica, SiO ₂ (diss.) | 13.00 | - | Silver as Ag | 0.012 | 0.05 |
| Sodium as Na | 15.50 | - | Sulfate as SO ₄ | 150 | 1000 |
| Suspended Solids | - | - | Total Diss. Solids | 433 | 2000 |
| Turbidity | 5.00 | 5 NTU | Zinc as Zn | 0.023 | 5.0 |
| pH Units | 7.40 | 6.5-8.5 | Coliforms MPN/100 ml | < 2.2 | 2.2 |

Note: Limits taken from Utah State Public Drinking Water Regulations, Rev. 5-81.
Consult Regulations to determine if limits are maximum or recommended.

(1) Depends on maximum daily air temperature.

**PARK MEADOWS
WELL 1979
CHEMICAL ANALYSIS**

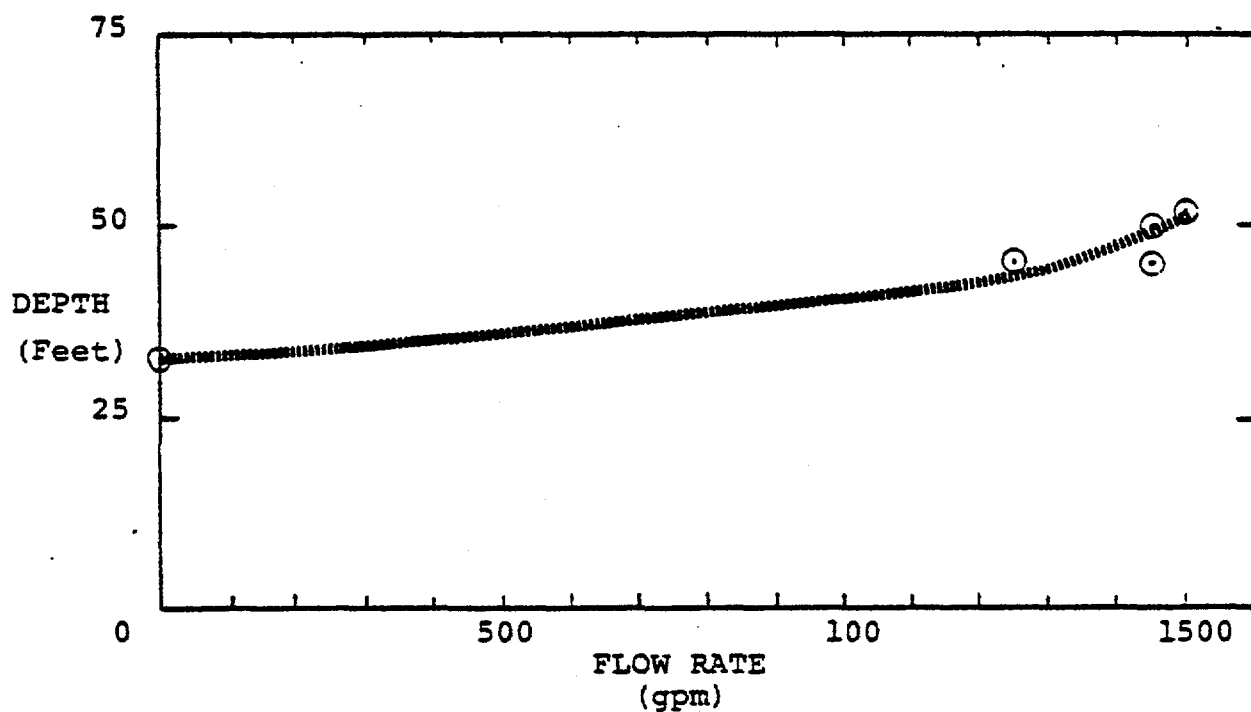


**FIGURE
24**

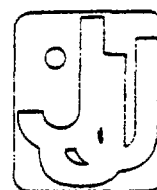
PARK MEADOWS WELL PUMP TEST

October 1979

| Time | Depth to Water Level (Feet) | Flow Rate (gpm) |
|-----------------|-----------------------------------|--------------------|
| 15:25 (10-2-79) | 33.0 | 0 |
| 15:55 | 43.0 | 1220 |
| 16:25 | 45.0 | 1450 |
| 17:30 | 45.0 | 1450 |
| 19:50 | 45.0 | 1240 |
| 22:20 | 45.0 | 1240 |
| 08:00 (10-3-79) | 33.0 | 0 |
| 08:25 | 50.0 | 1450 |
| 11:25 | 51.0 | 1450 |
| 14:25 | 52.0 | 1500 |
| 15:44 | 52.0 | 1500 |



**PARK MEADOWS
WELL
PUMP DRAWDOWN CURVE**



**FIGURE
25**

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 1

Opinion of Probable Cost

Satellite Wastewater Treatment Plants

Sheet 1 of 2

June 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|---|--|----------------|------------|------------------|
| East Canyon activated sludge satellite wastewater treat- ment plant | | | | |
| 1. | 1.5 million gallon per day (mgd) activated sludge wastewater treatment plant(3,4) | 1,500,000 Gal. | \$ 3.50 | \$5,250,000.00 |
| 2. | 20-inch diameter concrete sewerline | 300 L.F. | 45.00 | 13,500.00 |
| 3. | 4-foot diameter sanitary sewer manholes | 2 Each | 1,250.00 | 2,500.00 |
| 4. | Right-of-way permits and land acquisition | Job | L.S. | <u>20,000.00</u> |
| SUB TOTAL | | | | \$5,286,000.00 |

Silver Creek aerated lagoon
system - satellite waste-
water treatment plant

| | | | | |
|----|--|----------------|-------|----------------|
| 5. | 2.5 mgd aerated lagoon wastewater treatment plant(5) | 2,500,000 Gal. | 3.00 | \$7,500,000.00 |
| 6. | 8-inch diameter P.V.C. sewerline (4) | 2,500 L.F. | 13.20 | 33,000.00 |
| 7. | 12-inch diameter P.V.C. sewerline | 11,000 L.F. | 16.00 | 176,000.00 |

**OPINION OF
PROBABLE COST
ALTERNATIVE 1**



**FIGURE
26**

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|------|---|----------|-------------------------|-------------------------------|
| 8. | 4-foot diameter sanitary sewer manholes | 35 Each | 1,200.00 | 42,000.00 |
| 9. | Right-of-way permits and land acquisition | Job | L.S. | <u>20,000.00</u> |
| | | | SUB TOTAL | <u>\$ 7,771,000.00</u> |
| | | | TOTAL CONSTRUCTION COST | <u><u>\$13,057,000.00</u></u> |

- NOTES:
1. All items are furnished and installed.
 2. All unit costs based on 1982 construction costs.
 3. Sizing based on year 2000 peak population during the ski season using an average 100 GPCD to the nearest 0.5 mgd. Assume Silver Creek to East Canyon wastewater flow ratio is 2:1.
 4. Upgrading will not be required.
 5. See note 3; upgrading to a minimum 2.7 mgd will be required by year 2020..
 6. 8-inch sewerline to be installed as gravity line replacing existing force main connecting Park Meadows and Prospector Square.
 7. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: EMV
Checked by: JCH
Dept. Head: FCD

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 2

Opinion of Probable Cost

Recycle Snyderville Basin Sewer
Improvement District Wastewater Effluent

Total Length of Pipeline = 61,000 linear feet

Sheet 1 of 2

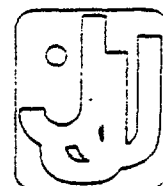
November 1982

| ITEM DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|---|-------------|------------|---------------|
| Recycle secondary treated effluent from existing East Canyon Treatment Facility to McLeod Creek at northern limits of Park City (860 gpm) | | | |
| 1. 12-inch diameter secondary effluent transmission main | 34,000 L.F. | \$19.00 | \$ 646,000.00 |
| 2. Pump station (two pumps building and interior piping) | Job | L.S. | 60,000.00 |
| 3. Right-of-way permits and land acquisition | Job | L.S. | 25,000.00 |
| 4. Power and telephone | Job | L.S. | 15,000.00 |
| SUB TOTAL | | | \$ 746,000.00 |

Recycle secondary treated effluent from proposed Silver Creek Treatment Facility to the northern limits of Park City (860 gpm)

| | | | |
|--|-------------|-------|---------------|
| 5. 12-inch diameter secondary effluent transmission main | 27,000 L.F. | 19.00 | \$ 513,000.00 |
| 6. Pump station (two pumps, building and interior pumping) | Job | L.S. | 30,000.00 |

**OPINION OF
PROBABLE COST
ALTERNATIVE 2**



**FIGURE
27**

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|-------------------------|---|----------|------------|------------------------------|
| 7. | Right-of-way permits and land acquisition | Job | L.S. | \$ 25,000.00 |
| 8. | Power and telephone | Job | L.S. | <u>15,000.00</u> |
| SUB TOTAL | | | | <u>\$ 583,000.00</u> |
| TOTAL CONSTRUCTION COST | | | | <u><u>\$1,329,000.00</u></u> |

- NOTES:
1. All items are furnished and installed.
 2. All unit costs are based on 1982 construction costs.
 3. Recycle transmission lines and pumps sized for future wastewater flows correspondent to year 2000, 70% occupancy, 2.5 people per unit, and 100 gpcd use.
 4. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: JCH
Checked by: HSE
Dept. Head: HSE

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 3

Opinion of Probable Cost
East Canyon Springs Pipeline

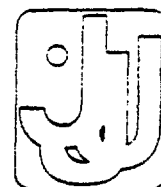
Total Length of Pipeline = 65,000 linear feet

Sheet 1 of 3

November 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|---|--|-------------|------------|-------------------|
| Schuster Creek area spring to Big Bear Hollow well sites, water transmission pipeline (design flow = 900 gpm) | | | | |
| 1. | Schuster Spring collection system(3) | Job | L.S. | \$ 50,000.00 |
| 2. | Pump station (two pumps, building and interior piping) | Job | L.S. | 40,000.00 |
| 3. | 12-inch diameter water transmission pipeline | 14,000 L.F. | \$25.00 | <u>350,000.00</u> |
| SUBTOTAL | | | | \$ 440,000.00 |
| Big Bear Hollow well sites to water treatment plant; water transmission pipeline (design flow = 2,700 gpm) | | | | |
| 4. | Well drilling, development and pumphouse construction(4) | 10 Ea. | 60,000.00 | 600,000.00 |
| 5. | East Canyon holding tank(5) | 20,000 Gal. | 0.75 | 15,000.00 |
| 6. | Pump station (four pumps, building and interior piping) | Job | L.S. | 100,000.00 |

**OPINION OF
PROBABLE COST
ALTERNATIVE 3**



**FIGURE
28**

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|------|--|----------------|------------|----------------------|
| 7. | 16-inch diameter water transmission pipeline | 18,000 L.F. | \$31.00 | <u>\$ 558,000.00</u> |
| | | SUBTOTAL | | \$1,273,000.00 |
| | Water treatment plant to Park City water transmission pipeline (design flow = 4,090 gpm) | | | |
| 8. | 3 MGD water treatment plant(6) | 3,000,000 Gal. | 0.75 | 2,250,000.00 |
| 9. | Pump station (six pumps, building and interior piping) | Job | L.S. | 130,000.00 |
| 10. | 20-inch diameter water transmission pipeline | 33,000 L.F. | 37.00 | 1,221,000.00 |
| 11. | Highway crossing | Job | L.S. | <u>50,000.00</u> |
| | | SUBTOTAL | | \$3,651,000.00 |
| 12. | Telemetry system | Job | L.S. | 100,000.00 |
| 13. | Right-of-way permits and land acquisitions | Job | L.S. | 25,000.00 |
| 14. | Power and telephone | Job | L.S. | <u>30,000.00</u> |
| | | SUBTOTAL | | \$ 155,000.00 |

Summary

| | |
|---------------------------------|-------------------|
| Subtotal of Items 1 through 3 | \$ 440,000.00 |
| Subtotal of Items 4 through 7 | 1,273,000.00 |
| Subtotal of Items 8 through 11 | 3,651,000.00 |
| Subtotal of Items 12 through 14 | <u>155,000.00</u> |

| | |
|-------------------------|------------------------------|
| TOTAL CONSTRUCTION COST | <u><u>\$5,519,000.00</u></u> |
|-------------------------|------------------------------|

- NOTES:
1. All items are furnished and installed.
 2. All unit prices are based on 1982 construction costs.
 3. Collection system at Schuster Creek area spring includes gravel, underdrain, piping, and collection box system.
 4. Unit costs for wells drilled, cased and equipped.
 5. Holding tank to combine all spring, well and water treatment flows for temporary pre-pump storage.
 6. Water treatment plant sized for average daily flow during ski season. The facility will treat only East Canyon Creek water equivalent to Park City's wastewater flow. If bacteriology tests prove that spring and or well water requires treating, treatment capacity will be increased to accommodate extra flow.
 7. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: JCH
 Checked by: WJ
 Dept. Head: WJ

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 4

Opinion of Probable Cost

East Canyon Creek Pipe Line

Total Length of Pipeline = 40,000 linear feet

Sheet 1 of 1

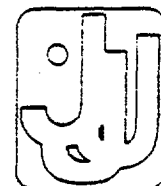
June 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|-------------------------|---|----------------|------------|------------------------------|
| 1. | 2,000,000 gallon per day water treatment plant(3,4) | 3,000,000 Gal. | \$ 0.75 | \$2,250,000.00 |
| 2. | Pump station (two 300 hp pumps, building and interior piping) | Job | L.S. | 70,000.00 |
| 3. | 16-inch diameter force transmission waterline | 40,000 L.F. | 27.00 | 1,080,000.00 |
| 4. | Highway crossing | Job | L.S. | 50,000.00 |
| 5. | Telemetry | Job | L.S. | 40,000.00 |
| 6. | Right-of-way permits and land acquisition | Job | L.S. | 20,000.00 |
| 7. | Power and telephone | Job | L.S. | <u>15,000.00</u> |
| TOTAL CONSTRUCTION COST | | | | <u><u>\$3,525,000.00</u></u> |

- NOTES:
1. All items furnished and installed.
 2. All costs based on 1982 construction costs.
 3. Water treatment plant sizing based average ski season population using an average wastewater flow of 100 gpcd in the year 2000.
 4. 2.70 mgd capacity is the average wastewater flow projected for year 2020.
 5. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: EMV
Checked by: JCH
Dept. Head: EDD

**OPINION OF
PROBABLE COST
ALTERNATIVE 4**



**FIGURE
29**

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 5

Opinion of Probable Cost

Smith-Morehouse Water Exchange

Sheet 1 of 1

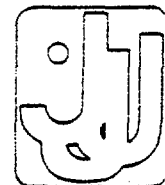
June 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|-------------------------|--|----------|------------|----------------------------|
| 1. | Pump Station - four 360 hp concrete sumphouse, discharge piping, starter panels(3) | Job | L.S. | \$200,000.00 |
| 2. | 12-inch diameter discharge column with utility cables | 900 L.F. | \$60.00 | 54,000.00 |
| 3. | Discharge column outlet works | Job | L.S. | 30,000.00 |
| 4. | Drain tunnel portal outlet and piping | Job | L.S. | 50,000.00 |
| 5. | Flow diversion structure and piping | Job | L.S. | 50,000.00 |
| 6. | Phone and power | Job | L.S. | 20,000.00 |
| 7. | Weber-Provo Diversion Canal improvements(4) | Job | L.S. | <u>50,000.00</u> |
| TOTAL CONSTRUCTION COST | | | | <u><u>\$454,000.00</u></u> |

- NOTES:
1. All items are furnished and installed.
 2. All costs are based on 1982 construction costs.
 3. Pump station and accessories to be installed in Ontario Shaft #3.
 4. Improvement shall be made if requested by the Weber Basin Water Conservancy District.
 5. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: EMV
Checked by: JCH
Dept. Head: RED

**OPINION OF
PROBABLE COST
ALTERNATIVE 5**



**FIGURE
30**

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 6

Opinion of Probable Cost

Smith-Morehouse Reservoir Pipeline

Total Length of Pipeline = 143,000 linear feet

Sheet 1 of 1

June 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|-------------------------|---|---------------|------------|------------------------------|
| 1. | 6 mgd water treatment plant | 6,000,000 Gal | \$.40 | \$2,400,000.00 |
| 2. | 22-inch water transmission line(3) | 143,000 L.F. | 39.00 | 5,577,000.00 |
| 3. | Power and phone | Job | L.S. | 30,000.00 |
| 4. | Right-of-way permits and land acquisition | Job | L.S. | <u>50,000.00</u> |
| TOTAL CONSTRUCTION COST | | | | <u><u>\$8,057,000.00</u></u> |

- NOTES:
1. All items are furnished and installed.
 2. All costs are based on 1982 construction costs.
 3. 75% of the transmission water line will be in earth shoulder.
 4. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: EMV
Checked by: JCH
Dept. Head: RCF

**OPINION OF
PROBABLE COST
ALTERNATIVE 6**

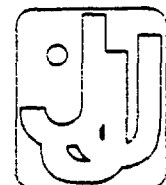


FIGURE
31

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 7

Opinion of Probable Cost

Weber River/Oakley Transmission Pipeline

Total Length of Pipeline = 82,000 linear feet

Sheet 1 of 1

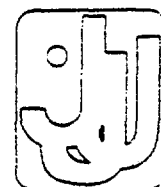
June 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|-------------------------|---|----------------|------------|------------------------------|
| 1. | Diversion dam/transmission system(3) | Job | L.S. | \$ 200,000.00 |
| 2. | 6.0 mgd water treatment plant | 6,000,000 Gal. | \$.40 | 2,400,000.00 |
| 3. | Pump Station (six 225 hp pumps, building and interior piping) | Job | L.S. | 140,000.00 |
| 4. | 22-inch diameter ductile iron transmission line | 82,000 L.F. | 39.00 | 3,198,000.00 |
| 5. | Phone and power | Job | L.S. | 30,000.00 |
| 6. | Right-of-way permits and land acquisition | Job. | L.S. | <u>50,000.00</u> |
| TOTAL CONSTRUCTION COST | | | | <u><u>\$6,018,000.00</u></u> |

- NOTES:
1. All items are furnished and installed.
 2. All costs are based on 1982 construction costs.
 3. Collect water from Weber River, pump and transmit to water treatment facility.
 4. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: EJV
Checked by: JCH
Dept. Head: EDD

**OPINION OF
PROBABLE COST
ALTERNATIVE 7**



FIGURE

32

PARK CITY WATER RESOURCES STUDY
ALTERNATIVE 8

Opinion of Probable Cost

Park Meadows Well No. 2

Sheet 1 of 1

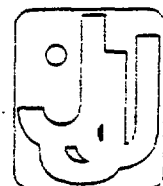
June 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|-------------------------|---|------------|------------|----------------------------|
| 1. | Drill, case, develop, and test well(3) | Job | L.S. | \$ 60,000.00 |
| 2. | Pumphouse (360 hp pump, housing and interior piping | Job | L.S. | 80,000.00 |
| 3. | Integrate with telemetry system | Job | L.S. | 8,000.00 |
| 4. | 14-inch diameter P.V.C. waterline | 3,400 L.F. | \$30.00 | <u>\$102,000.00</u> |
| TOTAL CONSTRUCTION COST | | | | <u><u>\$250,000.00</u></u> |

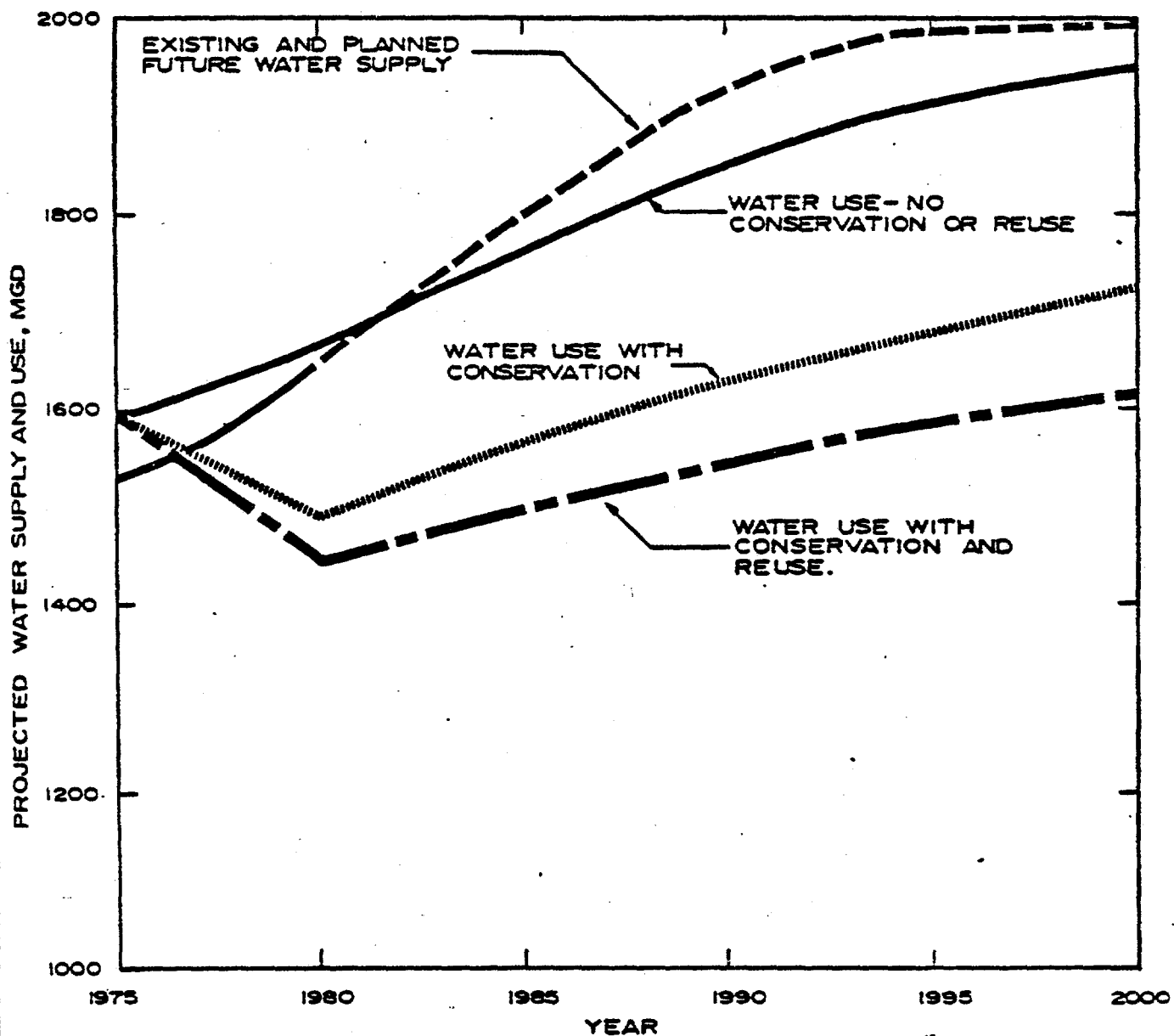
- NOTES:
1. All items are furnished and installed.
 2. All unit costs based on 1982 construction costs.
 3. Drill well for 24-inch diameter.
 4. Since the engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an engineer familiar with the construction industry. However, the engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: EMV
Checked by: JCH
Dept. Head: EC

**OPINION OF
PROBABLE COST
ALTERNATIVE 8**



**FIGURE
33**

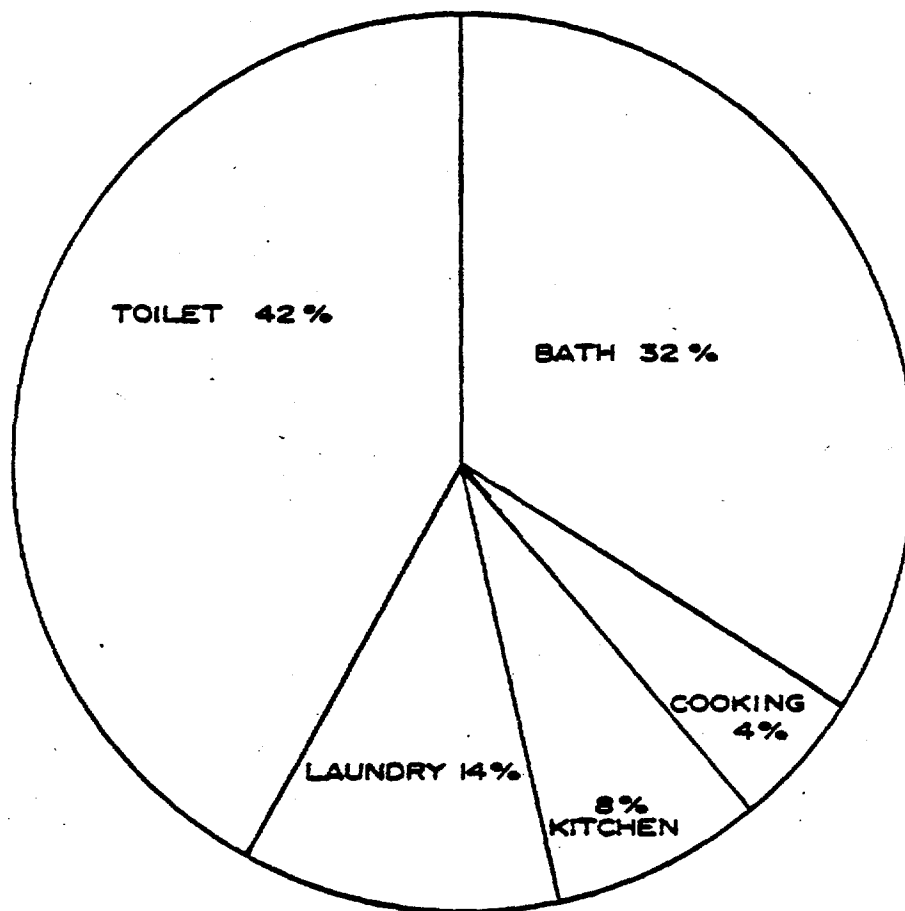


SOURCE: WATER CONSERVATION
REUSE AND SUPPLY - SAN FRANCISCO
BAY REGION, PREPARED FOR THE
ASSOCIATION OF BAY AREA
GOVERNMENTS. 1977

ASSESSMENT OF WATER SUPPLY CONSERVATION AND REUSE POTENTIAL



**FIGURE
34**

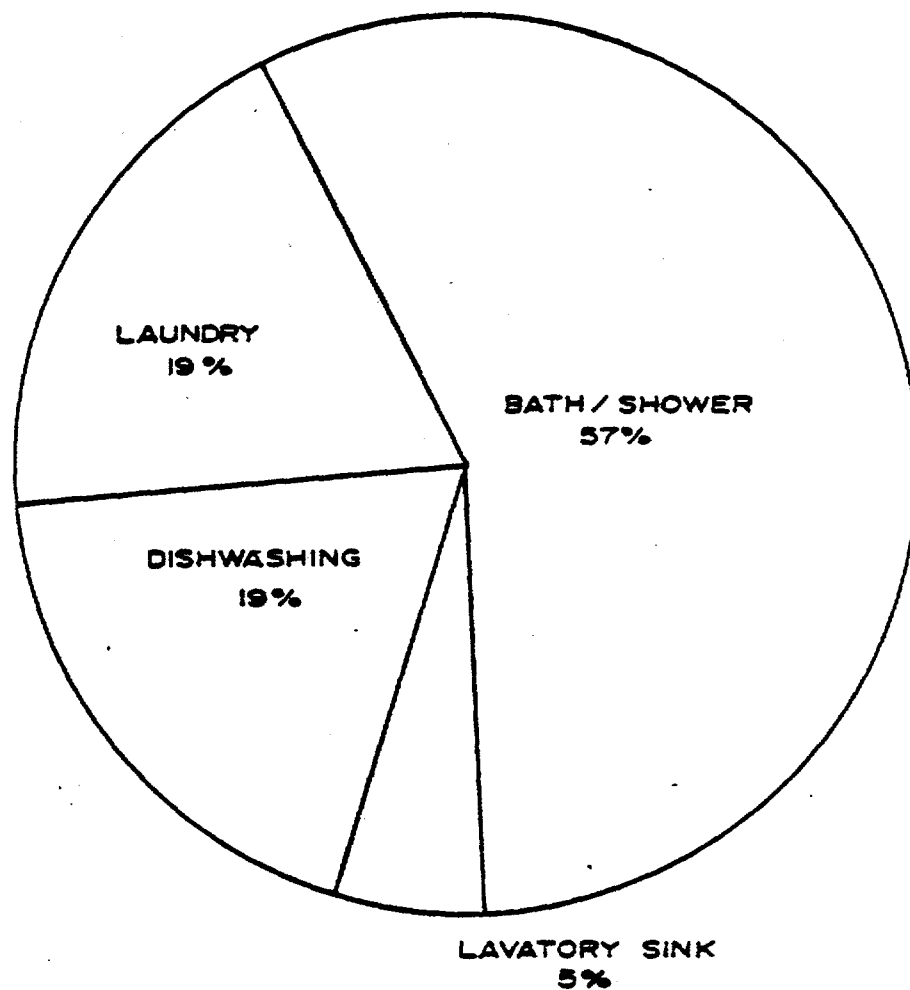


SOURCE: WATER CONSERVATION
IN CALIFORNIA. CALIFORNIA DEPT.
WATER RESOURCES. BULL. 198,
SACRAMENTO, CALIFORNIA
MAY 1976

**TYPICAL RESIDENTIAL
INSIDE WATER USE**



**FIGURE
35**



SOURCES (1) FLACK, J.E. 1981. ACHIEVING URBAN WATER CONSERVATION. A HANDBOOK. COLORADO WATER RES. INST. COMPLETION REPORT 80. COLORADO STATE UNIV., FORT COLLINS, COLO. (SEP. 1977). (2) THE CALIFORNIA APPLIANCE EFFICIENCY PROGRAM. REVISED STAFF REPT CALIFORNIA ENERGY RESOURCES CONSERVATION & DEVEL. COMM. CONSERVATION DIVISION (NOV. 1977)

AVERAGE RESIDENTIAL HOT WATER USE

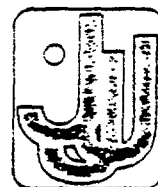


FIGURE
36

C. LIST OF EXHIBITS

1. Park City Service Area
2. The Study Area
3. Water Rights
4. Alternative 1: Satellite Wastewater Treatment Plants
5. Alternative 2: Recycle SBSID Wastewater Effluent
6. Alternative 3: East Canyon Springs - Transmission Pipeline
7. Alternative 4: East Canyon Creek - Transmission Pipeline
8. Alternative 5: Smith-Morehouse Water Exchange
9. Alternative 6: Smith-Morehouse - Transmission Pipeline
10. Alternative 7: Weber River/Oakley - Transmission Pipeline
11. Alternative 8: Park Meadows Well No. 2

APPENDIX

- A-1 THE STUDY AREA
 - Climate
 - Geology
 - Topography
 - Surface Water
 - Ground Water
- A-2 REVIEW OF LITERATURE
 - Demographic Analysis
 - Water use Function
- A-3 UTAH STATE DEPARTMENT OF HEALTH, STANDARDS OF QUALITY FOR WATERS OF UTAH, SELECTED PORTIONS
- A-4 JUDGE/ANCHOR TUNNEL REPORT
 - Introduction
 - Observations and Problems
 - Recommendations
 - Conclusions
 - Exhibit A
- A-5 UTAH STATE DEPARTMENT OF HEALTH REQUIREMENTS FOR APPROVALS
 - Introduction
 - Letter from Bureau of Public Water Supplies
 - State of Utah Public Drinking Water Regulations
- A-6 WATER USE AT VAIL, COLORADO, 1971-1973
- A-7 LIST OF REFERENCES

A-1

THE STUDY AREA

Climate

Geology

Topography

Surface Water

Ground Water

APPENDIX A-1

Climate

The general climate of the study area is characterized by low humidity, abundant sunshine with relatively light precipitation, and a large range of annual temperatures. The frost-free irrigation season generally averages 75 days.

Summer temperatures are moderate with highs averaging 65° to 75° F and lows ranging between 45° and 55° F. Daytime and nighttime temperatures fluctuate as much as 35° F. Winter daytime temperatures average 25° F with lows ranging from 0° to 18° F. Winter day and night temperatures fluctuate approximately 20° F. Temperatures above 95° F in the summer and less than minus 20° F in the winter occur approximately one season out of four.

Mean annual precipitation is 19 inches at an elevation of 7,050 feet above mean sea level (M.S.L.). The mean annual snowfall at this elevation is approximately 143 inches. Mean annual precipitation in the surrounding valley areas averages about 16 inches. Mountainous areas approach 40 to 50 inches in annual precipitation.

Most of the precipitation occurs from October through May. On the average, precipitation is heaviest in March and April. Thunderstorms account for most of the moisture during August, which is usually the wettest month of the summer. The hydrologic effects of thunderstorms are usually negligible as low humidity coupled with relatively high daytime temperatures quickly evaporate moisture in soil.

Prevailing winds flow in a west to east pattern. Winds in the mountainous and valley areas are generally not greater than 20 to 40 miles per hour (mph). However, strong winds approaching 50 to 60 mph or higher are not uncommon in the mountains during winter. Similar strong winds are also associated with summer thunderstorms.

Geology

The geologic formations in the study area generally consist of metamorphic quartzites and sedimentary sandstones, limestones, shales and alluvial deposits ranging in age from Lower Mississippian (345 million years ago) to more recent Quaternary (500,000 years ago).

The predominant surface geologic formation is the unconsolidated quaternary alluviums or glacial and river silt, sand and gravel deposits comprising over 40 percent of the land area. Several outcroppings of the Nugget Sandstone, Twin Creek Limestone Quartzite, Weber, Thaynes and Ankarah Shale, Limestone, Sandstone and Quartzite formations occur within the mountainous terrain of the study area and provide the consolidated members of the local geology. The intrusive igneous rocks of upper Permian Age (250 million years ago), although not continuous within the study area, have provided significant mining material in the past.

Extensive faulting has occurred in a large number of localities and has provided the basis of significant fracture zones found in the area to be of water bearing capacities. All fault zones within the study area are regarded as inactive.

The geology of the outlying areas also consists of significant alluvial deposits, but contains as its primary feature extrusive igneous and andesite pyroclastics (or volcanics) of Tertiary Age (65 million to 3 million years ago). In addition, the orogenic rise or mountainous growth of the Uintas reveals limestones of earlier ages tracing back to the Precambrian period or over 500 million years ago.

Topography

The relief within the study area varies from a high of 10,000 feet above M.S.L. in the Wasatch Range to a low of 6,600 feet above M.S.L. in the Richardson Flat area.

The topography ranges from gently sloping to moderately sloping flood plains along the McLeod and Silver Creek drainages to extremely steep slopes in the Wasatch Mountain range (see Exhibit 2). The outlying areas of the study area exhibit the same range of topographic conditions with a relief variation of 7800 feet above M.S.L. in the Uinta portion of the Wasatch National Forest at the Smith-Morehouse area to 6,000 feet above M.S.L. in the Kamas Valley area.

The predominant features include the Wasatch Range along the west boundary of the study area from the East Canyon Reservoir northwest of the study area running South towards the Heber Valley. Gentler terrain, including the Keetly area, the West Hills, and the Kamas Valley, lies to the northeast and east. Rockport Lake, a reservoir along the Weber River, lies to the northeast of the study area and to the northwest of the Kamas Valley. West of the Kamas Valley are the Uinta Mountains (Wasatch National Forest), headwater source of the Weber River and the Smith-Morehouse Reservoir.

Surface Water

The major surface water sources of the study area are the McLeod, Kimball and Silver creeks. As components of the Weber River drainage area, these water courses eventually converge with the Weber River. McLeod Creek and Kimball Creek flow into the East Canyon Creek in the Snyderville Basin north of the study area which flows into the East Canyon Reservoir. Water from the Reservoir flows into the Weber River near Milton. Silver Creek merges with the Weber River at Wanship.

The headwaters of the Weber River Basin begin in the Uinta Mountains portion of the Wasatch National Forest. Major headwater tributaries include the South Fork Weber, East Fork Weber, Middle Fork Weber and the Smith-Morehouse Creek. The Smith-Morehouse Creek contains a 700 to 800 acre-foot reservoir in its drainage area, and plans have been initiated to enlarge the reservoir to 7,900 acre feet.

The Weber River continues west from the Wasatch National Forest into the Kamas Valley. Weber River drainage continues through the Kamas Valley through Oakley, Peoa and into the Rockport Reservoir. Immediately upstream from Oakley, a trans-basin (Weber Basin to Provo Basin) diversion is encountered, the Weber-Provo Diversion Canal. Some water is also diverted from Beaver Creek near Kamas into the Weber-Provo Diversion Canal. Presently, the Ontario Drain Tunnel No. 2 drains portions of existing mining shafts in the area and eventually runs into the Provo River via Drain Tunnel Creek.

Detained water from the Rockport Reservoir is released where the Weber River continues through Wanship at the Silver Creek/Weber River confluence, through Echo Reservoir, through Milton at the East Canyon Creek/Weber River confluence and finally to the Great Salt Lake.

The McLeod, Kimball and East Canyon creeks have been classified by the Utah State Division of Health as Class 2B, 3A and 4 (see Appendix A-7, Utah State Board of Health, Standards of Quality for Waters of the State). They have also been classified by the Utah Division of Wildlife Resources as Class III water, which are considered important fisheries where flow and water quality are closely monitored. Annual water flow on McLeod Creek has been observed to average 10 to 15 cubic feet per second (cfs) within the study area, with critical low flows of 6 to 7 cfs. Combined flow for the McLeod and Kimball Creeks at the East Canyon confluence has been observed to be 20 to 25 cfs. Annual water flow on East Canyon Creek has been observed to average 40 to 50 cfs with critical low flows of 15 cfs. Extreme flows for East Canyon Creek range from 0.20 cfs (recorded in December of 1964) to 872 cfs (recorded in May of 1952).

East Canyon Reservoir has the potential storage capacity of 49,010 acre feet of water. All water usage and downstream discharge is maintained by the Weber Basin Water Conservancy District (WBWCD).

All waters associated with the Weber River from the head waters to Rockport are classified by the State Board of Health as Class 2B, 3A and 4. In addition, the Utah Division of Wildlife Resources classifies these waters as Class III. The Weber River from its headwaters to Rockport Reservoir averages 150 cfs annually. Critical low flows are 38 to 40 cfs.

Silver Creek, converging with the Weber River at Wanship, is also a 2B, 3A and 4 State Board of Health classification. However, the Division of Wildlife Resources classifies this stream as Class IV, which is noted to be suitable for agricultural use but not an important fishery. Annual flows for Silver Creek average 3 to 5 cfs within the study area and 15 to

20 cfs at the point of confluence with the Weber River. Critical low flows from the study area to the confluence range from 0.5 to 1 cfs. Data for maximum flows have not been tabulated.

Ground Water

Three general groundwater sources exist within the study area:

- 1) Wells
- 2) Springs
- 3) Mining tunnels

The recovery of groundwater via well development has yielded two significant sources, the Pacific Bridge Well and the Park Meadows Well. Both sources have been established in consolidated deposits of the Woodside Formation and the Thaynes Formation respectively. Other principle aquifers, water bearing strata, include the Twin Creek Limestone and Nugget Sandstone formations. The ultimate yield from all the consolidated sources is directly dependent upon the potential for the wells to intersect major fracture zones. Although an abundance of groundwater has been proven by the water flows from local mine workings and springs, the low permeability and isolated fracturing of the major consolidated aquifers in deposits such as the Nugget Sandstone and Twin Creek Limestone sometimes yields low flows in developed wells. Consolidated deposits outside of the study area, including the Grit member of the Ankarah Formation, the Echo Conglomerate Formation and the Wanship Conglomerate Formation all in the East Canyon Creek, have shown or have been speculated to yield significant amounts of water.

Unconsolidated deposits, characteristically of glacial and/or river deposition origins, have not been proven in the study area. However, numerous wells drilled in the Snyderville Basin north of the study area have yielded low producing wells, capable of supplying domestic water for individual homes, and two moderate sources, the Hi-Ute Well (tested at 35 gpm) and the State Rest Stop Well (tested at 350 gpm). The latter two wells combined have the capacity to supply water to several subdivisions in the area. Other unconsolidated sources in the outlying areas of the study area have been noted in the Peoa area in the Kamas Valley.

Springs found in the study area show varied flows. The most significant water producing springs are the Sullivan Spring and the Theriot Spring. Other springs include the Dorrity Spring and springs located in Frog Valley, Deer Valley and Thaynes Canyon. The primary source of all springs within the study area is the consolidated deposits including the Thaynes, Nugget, Twin Creek, Park City and Weber Quartzite formations.

The extensive mining practices of the past have provided the area with significant quantities of water from the various consolidated deposits. The mining drainage Judge/Anchor Tunnel has historically been the primary water source for Park City. Its flows have been supplemented by drainage from the Alliance tunnel.

Other water sources from mining excavation include the Ontario Shafts (flows from which are conveyed via drain tunnels to the local streams), and the Spiro Tunnel, a source that has not been fully developed.

A-2 REVIEW OF THE LITERATURE

Demographic Analyses and Projections
Water Use and Demand Functions

A-2 REVIEW OF THE LITERATURE

The literature review is presented in two sections in order to relate various analyses to the research objectives of this study. The first section includes the review of literature concerning the procedures and results of recent demographic analyses and projections completed for the Park City/Snyderville Basin area. The second section will be a review of literature relating to the water demand and use functions compiled in the Park City/Snyderville Basin area, the State of Utah and other areas in the Western States region. The relation between water demand and use typically includes various demand determinants and their effects on both long-term demand (monthly and annually) and short-term demand (instantaneous to hourly). All literature contributing to this study is listed in Figure 1 in Section X.

Demographic Analyses and Projections

The Outlook for Growth - Park City/Snyderville Basin: A Market Perspective (Economic Research Associates, 1981):

The study's objective is to relate three primary growth potential factors ("economic engines") for the area:

- 1) Industrial development;
- 2) Residential development (in reaction to economic opportunities in the region);
- 3) Expansion of skiing and tourism activities in developing an industrial growth potential.

Economic Research Associates (ERA) analyzed the present growth trends in surrounding counties, particularly Salt Lake County, and the status of energy development in the overthrust region of Utah. In both instances, ERA concluded that industrial development will be modest due to a "monopolized" industrial growth in the Salt Lake area and an anticipated energy related growth primarily in the Evanston, Wyoming area east of Park City.

Commercial space, including retail, service, and office space, was estimated by ERA to be about 602,000 square feet currently in Park City. A housing inventory and report later done by the Park City Planning Staff reported approximately 761,000 square feet of existing commercial space in Park City.

ERA also forecasted an additional increase of about 240,000 square feet by the year 2000. Table 5 in Section XI includes these forecasts and reasonable interpolations associated with them. Broken down further, about 211,300 square feet was projected to be completed by 1990, with a further increase of another 226,100 square feet by 2000. Park City, compared to Kimball's Junction and the Snyderville area, was expected to contain the greatest potential for commercial growth of all types. These forecasted growth rates may be greater with unforeseen annexation of outlying areas and/or zoning changes not anticipated.

Residential development with respect to primary housing construction is expected to center in the Snyderville area. Such growth depended on this area becoming a "bedroom" community of Salt Lake City. Secondary housing, a direct function of the growing ski industry in Park City, was anticipated to account for 40 percent of residential construction. Overall, residential construction will increase approximately 550 units per year in the early 1980's to about 710 units per year in the late 1990's. Peak day population during the ski season was projected to be 45,000 in 1990 and 63,000 in 2000.

Sewer Master Plan Study (Snyderville Basin Sewer Improvement District, Kaiserman Associates, 1979):

Emphasizing wastewater concerns and the potential of possible unregulated growth, Snyderville Basin Sewer Improvement District (SBSID) based its population estimates on peak potential development. The study indicates an anticipated population growth of between 50,000 to 55,000 people by the year 2010 within the Snyderville Basin which includes Park City and areas east of Summit Park and Jeremy Ranch to Atkinson Spring. This can be equated to approximately 20,000 to 25,000 connections by the year 2010.

Comprehensive Water Report for Snyderville Basin (Call Engineering, 1974):

Future population projections to determine the maximum water consumption and its feasibility with known water sources and water rights were based upon twelve variables:

- 1) Potential building areas;
- 2) Presently planned developments;

- 3) Past growth rates;
- 4) Building permits issued;
- 5) Tax delinquency of property;
- 6) Development presently underway;
- 7) Unpublished studies and predictions;
- 8) Availability of services and utilities;
- 9) Recreational potential;
- 10) Present land use;
- 11) Topography;
- 12) Personal opinion and other miscellaneous considerations.

Call Engineering divided the Snyderville Basin area into fourteen sections and applied their variables. Noting a conservative population projection, based on a "population equivalent" approach corresponding to peak days during the ski season, the Snyderville Basin population was estimated to be approximately 31,000 people by 1995, while the projection for Park City only 19,000.

Snyderville Basin Transportation Study (Summit County, 1982):

Summit County's demographic survey, although similar in approach to the SBSID population prediction, is based on potential growth as a result of maximum development supply. Summit County's projections are based upon the following criteria:

- 1) The definite growth of Snyderville Basin as a "bedroom community" to the Salt Lake City region. Summit County's approach to population growth has been based on the "bedroom community" as a full capacity potential for the Snyderville Basin area north of the Park West area (600 units existing, 1,300 units approved).

- 2) Park City growth; in addition to existing housing and commercial facilities, Summit County estimates 750 more condominium units, 625 restaurant and bar seats, 40,000 square feet of commercial area, a 9,500 square foot skating rink, 5,000 square feet of convention and assembly space, and upgrading its ski runs to handle 2,000 or more people per day (or 12,000 total skiers per day).
- 3) Deer Valley; 2,000 housing units; 12,600 skiers per day capacity. (This has since increased.)
- 4) Round Valley; 336 housing units;
- 5) Park West; 12,000 to 15,000 skiers per day capacity; 360 unit hotel and other commercial area.
- 6) Clissold property; 1,000 maximum units.
- 7) Harrington property; 160 units.
- 8) Lott property; 200-500 units.
- 9) Silver Springs Development; 2,000 to 2,400 units.
- 10) Mayflower; development units unknown.
- 11) Jordanelle Dam; development units unknown.
- 12) Condas property (White Pine Ski Resort); 3,000 units.

However, Summit County chose to simplify its approach to a population increase by using average densities per acre and calculated a maximum number of households to be 31,225. (No specific year was assigned to this development projection.)

Weber Basin Project - Utah - Negative Determination of Environmental Impacts, Snyderville Basin Area - East Canyon-Parley's Park (Bureau of Reclamation, 1975):

The Weber Basin Water Quality Study estimated a maximum population for the year 2000 to be 41,649 people.

Water Use and Demand Functions

Domestic Water Demand in Utah (Hughes and Gross, 1979):

The principal objective of this report was to establish a base design procedure in the determination of future water use by a "typical" community in Utah. Water demand parameters for both rural and urban areas were analyzed using statistical and empirical flows. The flow parameters were:

- 1) Average month;
- 2) Peak month;
- 3) Peak day;
- 4) Instantaneous peak.

Two models were employed in the formulation of general water use. Both models, one being 14 townships and the other 41, utilized a broad range of water dependent communities. Although the rural systems had higher instantaneous peaks due to a greater irrigation need, the authors found that average domestic daily use per capita was about equal for rural and urban areas. Moreover, through extensive use analysis, the authors concluded that total water use was solely a function of population growth and could not be based upon differences of the potential use habits between urban and rural populations.

Water Demand at Recreation Developments (Simon Lam and Trevor C. Hughes, Utah Water Research Laboratory, 1980):

This report was devoted to the demand determinants of recreational water use in the Western United States and how it compared with average municipal water use. In defining reasonable flow standards on recreational culinary water use, the authors chose several types of recreational developments, including mountain cabins, marinas, recreational vehicle campgrounds, and resort condominiums (with summer and winter peaks). The resort condominiums studied included:

- 1) Teton Village, Wyoming;
- 2) Snowbird, Utah;
- 3) Brianhead, Utah;

4) Sweetwater, Bear Lake, Utah.

Results of water demand studies for similar use conditions may be found in Table 3 of this study.

Design of Water and Wastewater Systems for Resorts and Boom Towns (J. Earnest Flack and Paul J. Gorder, 1975)

Flack and Gorder edited a 1975 workshop held at the University of Colorado, and produced a collection of reports concerning the design of water and wastewater systems for resorts and boom towns in the Western United States.

One of the papers that relied on empirical data was "Mountain Community Water Requirements," by Ronald K. Blatchley and William E. Green. The authors presented the results of a survey of water use in three mountain areas in Colorado: Evergreen, Vail Ski Resort, and Mount Werner area (Steamboat Springs Resort). The authors used the data on water use and population estimates in suggesting a procedure to estimate water uses for a proposed mountain resort area. Annual water use figures for Evergreen, a year-round community outside Denver, averaged 95 gallons per capita per day (gpcd) from 1968 through 1973 (in 1973, with a population of 4,810, average water use was 92 gpcd). All water figures included household, commercial, municipal, irrigation and second home uses.

Water use data for Vail, compiled from 1971 through 1973, averaged 128 gpcd. Water use data for the Mount Werner area, for the years 1972 and 1973, was not complete for similar analysis. The authors referenced the residential water use research project performed at Johns Hopkins University. It showed an average residential use of 109 gpcd, of which 6.3 gpcd was included for system leakage.

- 2) Park City growth; in addition to existing housing and commercial facilities, Summit County estimates 750 more condominium units, 625 restaurant and bar seats, 40,000 square feet of commercial area, a 9,500 square foot skating rink, 5,000 square feet of convention and assembly space, and upgrading its ski runs to handle 2,000 or more people per day (or 12,000 total skiers per day).
- 3) Deer Valley; 2,000 housing units; 12,600 skiers per day capacity. (This has since increased.)
- 4) Round Valley; 336 housing units;

- 5) Park West; 12,000 to 15,000 skiers per day capacity; 360 unit hotel and other commercial area.
- 6) Clissold property; 1,000 maximum units.
- 7) Harrington property; 160 units.
- 8) Lott property; 200-500 units.
- 9) Silver Springs Development; 2,000 to 2,400 units.
- 10) Mayflower; development units unknown.
- 11) Jordanelle Dam; development units unknown.
- 12) Condas property (White Pine Ski Resort); 3,000 units.

However, Summit County chose to simplify its approach to a population increase by using average densities per acre and calculated a maximum number of households to be 31,225. (No specific year was assigned to this development projection.)

Weber Basin Project - Utah - Negative Determination of Environmental Impacts, Snyderville Basin Area - East Canyon-Parley's Park (Bureau of Reclamation, 1975):

Quoting the Weber Basin Water Quality Study, this study estimated a maximum population for the year 2000 to be 41,649 people.

The Literature: Water Use and Demand Functions

Domestic Water Demand in Utah (Hughes and Gross, 1979):

The principal objective of the report was to establish a base design procedure in the determination of future water use by a "typical" community in Utah. Water demand parameters for both rural and urban areas were analyzed using statistical and empirical flows. The flow parameters were:

- 1) Average month;
- 2) Peak month;
- 3) Peak day;

4) Instantaneous peak.

Two models were employed in the formulation of general water use. Both models, one being 14 communities, the other 41 communities, utilized a broad range of water dependent communities. Although the rural systems had higher instantaneous peaks due to a greater irrigation need, the authors found that average domestic daily use per capita were about equal for rural and urban areas. Moreover, through extensive use analysis, the authors concluded that total water use was solely a function of population growth and could not be based upon differences of the potential use habits between urban and rural populations.

Water Demand at Recreation Developments (Simon Lam and Trevor C. Hughes, Utah Water Research Laboratory, 1980):

This report was devoted to the demand determinants of recreational water use in the Western United States and how it compared with average municipal water use. In defining reasonable flow standards on recreational culinary water use, the authors chose several types of recreational developments, including mountain cabins, marinas, recreational vehicle campgrounds, and resort condominiums (with summer and winter peaks). The resort condominiums studied included:

- 1) Teton Village, Wyoming;
- 2) Snowbird, Utah;
- 3) Brianhead, Utah;
- 4) Sweetwater, Bear Lake, Utah.

Results of water demand studies for similar use conditions may be found in Table 3 of this study.

Design of Water and Wastewater Systems for Resorts and Boom Towns (J. Earnest Flack and Paul J. Gorder, 1975)

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One of the papers that relied on empirical data was "Mountain Community Water Requirements," by Ronald K. Blatchley and William E. Green. The authors presented the

results of a survey of water use in three mountain areas in Colorado: Evergreen, Vail Ski Resort, and Mount Werner area (Steamboat Springs Resort). The authors used the data on water use and population estimates in suggesting a procedure to estimate water uses for a proposed mountain resort area. Annual water use figures for Evergreen, a year-round community outside Denver, averaged 95 gallons per capita per day (gpcd) from 1968 through 1973 (in 1973, with a population of 4,810, average water use was 92 gpcd). All water figures included household, commercial, municipal, irrigation and second home uses.

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A-3

UTAH STATE DEPARTMENT OF HEALTH
STANDARDS OF QUALITY FOR THE WATERS OF UTAH
SELECTED PORTIONS

A-3

STATE OF UTAH
DEPARTMENT OF SOCIAL SERVICES
DIVISION OF HEALTH

WASTEWATER DISPOSAL REGULATIONS

PART II
STANDARDS OF QUALITY FOR WATERS OF THE STATE

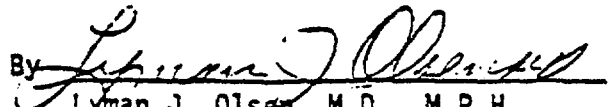
Adopted By
Utah Water Pollution Control Board May 18, 1965
Utah State Board of Health May 19, 1965

Revised by Action of the Boards June 2, 1967 and June 21, 1967

Further Revised by Action of the Utah Water Pollution Committee
November 18, 1968 and September 13, 1978, and by Action of the
Utah State Board of Health November 20, 1968 and October 23, 1978

Under Authority of
26-15-4 & 5 and 73-14-1 through 13
Utah Code Annotated 1953, as Amended

Certified Official Copy
Utah State Division of Health

By 
Lyman J. Olsen, M.D., M.P.H.
Director of Health

UTAH STATE DEPARTMENT OF HEALTH
STANDARDS OF QUALITY FOR THE WATERS OF UTAH

PART II - Page 5

2.6 USE DESIGNATIONS

The Committee and Board, as required by 73-14-6 and 63-46-1 through 13, Utah Code Annotated 1953, as amended, shall group the waters of the state into classes so as to protect against controllable pollution the beneficial uses designated within each class as set forth below. Waters of the state classified as shown in Appendix B.

2.6.1 Class 1 -- protected for use as a raw water source for domestic water systems.

- a. Class 1A -- protected for domestic purposes without treatment.
- b. Class 1B -- protected for domestic purposes with prior disinfection.
- c. Class 1C -- protected for domestic purposes with prior treatment by standard complete treatment processes as required by the Utah State Division of Health.

2.6.2 Class 2 -- protected for in-stream recreational use and aesthetics.

- a. Class 2A -- protected for recreational bathing (swimming).
- b. Class 2B -- protected for boating, water skiing, and similar uses, excluding recreational bathing (swimming).

2.6.3 Class 3 -- protected for in-stream use by beneficial aquatic wildlife.

- a. Class 3A -- protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
- b. Class 3B -- protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
- c. Class 3C -- protected for non-game fish and other aquatic life, including the necessary aquatic organisms in their food chain. Standards for this class will be determined on a case-by-case basis. (See Appendix D).
- d. Class 3D -- protected for waterfowl, shorebirds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.

2.6.4 Class 4 - protected for agricultural uses including irrigation of crops and stockwatering.

2.6.5 Class 5 - protected for industrial uses including cooling, boiler make-up, and others with potential for human contact or exposure. Standards for this class will be determined on a case-by-case basis.

2.6.6 Class 6 - protected for uses of waters not generally suitable for the uses identified in Sections 2.6.1 through 2.6.5, above. Standards for this class will be determined on a case-by-case basis.

2.7 WATER QUALITY STANDARDS

2.7.1 Application of Standards

The standards listed in Appendix A shall apply to each of the classes assigned to waters of the State as specified in Section 2.6 of these regulations. It shall be unlawful and a violation of these regulations for any person to discharge or place any wastes or other substances in such manner as may interfere with designated uses protected by assigned classes or to cause any of the applicable standards to be violated, except as provided in Section 1.3.1.

2.7.2 Narrative Standards

It shall be unlawful, and a violation of these regulations, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste; or conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, as determined by bio-assay or other tests performed in accordance with standard procedures determined by the Committee.

2.8 PROTECTION OF DOWNSTREAM USES

All actions to control waste discharges under these regulations shall be modified as necessary to protect downstream designated uses.

NUMERICAL STANDARDS FOR PROTECTION OF
BENEFICIAL USES OF WATER

| Constituent | CLASSES | | | | | | | | | | | |
|-------------------------------------|-----------------|---------|---------|-------------------------|---------|------------------|---------|----|--------------|-----------|---------|---|
| | Domestic Source | | | Recreation & Aesthetics | | Aquatic Wildlife | | | Agri-culture | Indus-try | Special | |
| | 1A | 1B | 1C | 2A | 2B | 3A | 3B | 3C | 3D | 4 | 5 | 6 |
| Bacteriological (No./100 ml) | | | | | | | | | | | | |
| (30-day Geometric Mean) | | | | | | | | | | | | |
| Maximum Total Coliforms | 1 | 50 | 5,000 | 1,000 | 5,000 | * | * | | * | * | | |
| Maximum Fecal Coliforms | * | * | 2,000 | 200 | 2,000 | * | * | | * | * | | |
| Physical | | | | | | | | | | | | |
| Total Dissolved Gases | * | * | * | * | * | (b) | (b) | | * | * | | |
| Minimum DO (mg/l) (a) | * | * | 5.5 | 5.5 | 5.5 | 6.0 | 5.5 | | 5.5 | * | | |
| Maximum Temperature | * | * | * | * | * | 20°C | 27°C | | * | * | | |
| Maximum Temp. Change | * | * | * | * | * | 2°C | 4°C | | * | * | | |
| pH | 6.5-9.0 | 6.5-9.0 | 6.5-9.0 | 6.5-9.0 | 6.5-9.0 | 6.5-9.0 | 6.5-9.0 | | 6.5-9.0 | 6.5-9.0 | | |
| Turbidity increase (c) | * | * | * | 10 NTU | 10 NTU | 10 NTU | 10 NTU | | 15 NTU | * | | |
| Chemical (Maximum mg/l) | | | | | | | | | | | | |
| Arsenic, dissolved | .05 | .05 | .05 | * | * | * | * | | * | .1 | | |
| Barium, dissolved | 1 | 1 | 1 | * | * | * | * | | * | * | | |
| Cadmium, dissolved | .010 | .010 | .010 | * | * | .0004(d) | .004(d) | | * | .01 | | |
| Chromium, dissolved | .05 | .05 | .05 | * | * | .10 | .10 | | .10 | .10 | | |
| Copper, dissolved | * | * | * | * | * | .01 | .01 | | * | .2 | | |
| Cyanide | * | * | * | * | * | .005 | .005 | | * | * | | |
| Iron, dissolved | * | * | * | * | * | 1.0 | 1.0 | | 1.0 | * | | |
| Lead, dissolved | .05 | .05 | .05 | * | * | .05 | .05 | | * | .1 | | |
| Mercury, total | .002 | .002 | .002 | * | * | .00005 | .00005 | | .00005 | * | | |
| Phenol | * | * | * | * | * | .01 | .01 | | * | * | | |
| Selenium, dissolved | .01 | .01 | .01 | * | * | .05 | .05 | | * | .05 | | |
| Silver, dissolved | .05 | .05 | .05 | * | * | .01 | .01 | | * | * | | |
| Zinc, dissolved | * | * | * | * | * | .05 | .05 | | * | * | | |
| NH ₃ as N (un-ionized) | * | * | * | * | * | .02 | .02 | | * | * | | |
| Chlorine | * | * | * | * | * | .002 | .01 | | * | * | | |
| Fluoride, dissolved (e) | 1.4-2.4 | 1.4-2.4 | 1.4-2.4 | * | * | * | * | | * | * | | |
| NO ₃ as N | 10 | 10 | 10 | * | * | * | * | | * | * | | |
| Boron, dissolved | * | * | * | * | * | * | * | | * | .75 | | |
| N ₂ S | * | * | * | * | * | .002 | .002 | | * | * | | |
| TDS (f) | * | * | * | * | * | * | * | | * | 1200 | | |
| Radiological (Maximum pCi/l) | | | | | | | | | | | | |
| Gross Alpha | 15 | 15 | 15 | * | * | 15(g) | 15(g) | | 15(g) | 15(g) | | |
| Radium 226, 228 combined | 5 | 5 | 5 | * | * | * | * | | * | * | | |
| Strontium 90 | 8 | 8 | 8 | * | * | * | * | | * | * | | |
| Tritium | 20,000 | 20,000 | 20,000 | * | * | * | * | | * | * | | |
| Pesticides (Maximum ug/l) | | | | | | | | | | | | |
| Endrin | .2 | .2 | .2 | * | * | .004 | .004 | | .004 | * | | |
| Lindane | 4 | 4 | 4 | * | * | .01 | .01 | | .01 | * | | |
| Methoxychlor | 100 | 100 | 100 | * | * | .03 | .03 | | .03 | * | | |
| Toxaphene | 5 | 5 | 5 | * | * | .005 | .005 | | .005 | * | | |
| 2, 4-D | 100 | 100 | 100 | * | * | * | * | | * | * | | |
| 2, 4, 5-TP | 10 | 10 | 10 | * | * | * | * | | * | * | | |
| Pollution Indicators (g) | | | | | | | | | | | | |
| Gross Beta (pCi/l) | 50 | 50 | 50 | * | * | 50 | 50 | | 50 | 50 | | |
| BOD (mg/l) | * | * | 5 | 5 | 5 | 5 | 5 | | 5 | 5 | | |
| NO ₂ as N (mg/l) | * | * | * | 4 | 4 | 4 | 4 | | * | * | | |
| PO ₄ as P (mg/l)(h) | * | * | * | .05 | .05 | .05 | .05 | | * | * | | |

* Insufficient evidence to warrant the establishment of numerical standard. Limits assigned on case-by-case basis.

(e) Maximum concentration varies according to the daily maximum mean air temperature.

| Temp. | p _c | mg/l |
|----------------|----------------|------|
| 12.0 and below | | 2.4 |
| 12.1 to 14.6 | | 2.2 |
| 14.7 to 17.6 | | 2.0 |
| 17.7 to 21.4 | | 1.8 |
| 21.5 to 26.2 | | 1.6 |
| 26.3 to 32.5 | | 1.4 |

(a) These limits are not applicable to lower water levels in deep impoundments.

(b) Not to exceed 110% of saturation.

(c) For Classes 2A, 2B, 3A, and 3B at background levels of 100 NTUs or greater, a 10% increase limit will be used instead of the numeric values listed. For Class 3D at background levels of 150 NTUs or greater, a 10% increase limit will be used instead of the numeric value listed. Short term variances may be considered on a case-by-case basis.

(d) Limit shall be increased threefold if CaCO₃ hardness in water exceeds 150 mg/l.

(f) Total dissolved solids (TDS) limit may be adjusted on a case-by-case basis.

(g) Investigations should be conducted to develop more information where these pollution indicator levels are exceeded.

(h) PO₄ as P(mg/l) limit for lakes and reservoirs shall be .025.

STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS

STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS

A-4

JUDGE/ANCHOR TUNNEL REPORT

Introduction

Observations and Problems

Recommendations

Conclusions

Exhibit

- C. First Cave-In: Within the first 1,000 to 1,500 feet of the tunnel, we encountered the first cave-in which has covered approximately the south half of the tunnel. However, it did not appear to be obstructing the flow as of yet. This caving was occurring in the black shale area which is a medial phosphitic shale member of the Park City formation. There are some sets and lacing in this area, although some additional work should be done.
- D. Judge Shaft: As we moved on into the tunnel we encountered the third source of water loss, that being the Judge Shaft (vertical opening up from the tunnel). There is approximately 100 gallons of water per minute cascading down the shaft, the majority of which continues on down to lower levels below where we stood. There has been an attempt to collect some of this water with several sections of corrugated metal. However, it is very ineffective, and probably only 5 percent of the flow is being directed on down the Judge Tunnel to the City's supply lines, with the remainder being allowed to continue down the shaft.
- E. Old Water Tunnel: From the Judge Shaft area, the tunnel splits into three different tunnels, one being the old water tunnel which was constructed many years ago to drain away water from areas where stoping out (mining) operations for ore were taking place in the No. 1275 tunnel. This No. 1275 tunnel continues in a loop from the Judge Shaft area and intersects the "new water tunnel" which was constructed in 1974 and 1975 with funds obtained from the Utah Board of Water Resources' revolving construction fund. This new tunnel was constructed because the old water tunnel continued to cave and would not allow full flow of water through it. The old tunnel also required pumping of a large quantity of flow, but it has now caved to the point where it is no longer passable. Some water is still issuing from it, but only on the order of about 50 gallons a minute.
- F. No. 9 Fault Cave-In Area: We continued up the new water tunnel and found it, for the most part, in excellent condition. However, near the upper end of it, and near its junction with the No. 1275 tunnel, there is a fault area called the "No. 9 fault." This area continues to cave and now has caved to the point

JUDGE ANCHOR TUNNEL WATER FLOW INVESTIGATION

April 9, 1982

Prepared for
Park City Municipal Corporation

1. A minimum of 16-inch steel pipe should be installed to replace the two ten-inch diameter PVC pipes which supply water to the collection box just outside of the mine portal. The larger pipe would be less susceptible to being clogged with debris. This debris could go on down into the collection box where it could be more easily handled with screens and/or grates.
2. To best protect the City's supply, the collection box could be modified such that the water would first enter a settling basin which would help to settle out any heavy suspended material. It would then fall over a weir through some grates, and then thru a submerged orifice. The orifice would allow any floating debris which may have fallen from the mining timbers, etc. to continue to float or be caught on the grate and kept from City's system. From here the water would flow into the City's 14-inch supply line which ultimately supplies the Empire Water Storage Tank. Hydraulically, the existing intake set up is more than adequate to handle the flow, but it is more susceptible to clogging by debris.

B. General Mine Repair and Maintenance: As mine water sources are highly susceptible to caving problems and debris, we feel some of the most important measures that can be undertaken in the mine to protect the continuity of the flow would be:

1. To repair and replace rotten lagging to allow speedy access of maintenance people into the mine at any time.
2. All caved areas should be mucked out as soon as possible, or as soon as they are discovered, such that they do not build up and possibly dam off or impede the flow.
3. A regular inspection and maintenance schedule should be followed to assure that the tunnel and its water source facilities are in acceptable condition.

I. Introduction

Over the last two or three years, the flow in the Judge Anchor Tunnel varies from 1,200 gpm during the high flow period of May, June and July, to 500 gpm during the low flow period of March and April. However, during heavy mining activity utilizing dewatering pumps, the water discharge has been as high as 4.0 to 4.5 cfs.

II. Observations and Problems

On the day we were in the tunnel, Rich Martinez indicated that the flow looked normal to him for this time of the year. The flow was estimated at approximately 600 to 800 gallons per minute. The following is a list of problems which we encountered as we went from the portal of the tunnel back to the main headwaters of the Judge Anchor source. To clarify the problem areas, we have included a location map, listed as Exhibit "A", with this report. The problem areas are lettered in correspondence with the lettered paragraphs.

- A. Entrance Conditions: Just inside the locked steel gate at the portal of the mine are the two intake pipes which feed the Empire Canyon Water Tank. These pipes are both ten-inch diameter PVC Class 150 pipes. According to Rich Martinez and Bob Lashier, the City has had considerable problems over the years in keeping these pipes open, clear of floating wood debris and small rock fragments that move down the ditch within the tunnel during high flows. We estimated that the intake pipes are installed at a slope of about 1 percent. If this is the case, they would be capable of over 2,500 gpm. This is well in excess of any known historic peak flows. The clogging problem still exists and should be resolved immediately.
- B. General Mine Repair and Maintenance: Throughout the tunnel we noticed that there were numerous areas where lagging (the plank which one walks on as he goes through the Tunnel) was missing or was rotten and unsafe to walk on. In general, most of the sills (wooden rail ties) appeared to be in good shape, as well as most of the sets (vertical supports) and lacing (horizontal top and side supports), which are used for shoring in areas of frequent caving action.

IV. Additional Recommendations

- A. Weir Water Measurement Program: A series of V-notch weirs properly located from the portal of the tunnel up to the very headwaters should be set up to better detect whether or not the City is gaining or losing water throughout the tunnel. A weir program could be undertaken for minor cost, and it would give some indication as to which sections should be piped and which ones should not.
- B. Existing Noranda Pumps: Efforts might be directed toward asking for and gaining permission to use the existing Noranda pumps, which pump water from the 900 level of the Daly West Tunnel to the 750 level (the Judge Anchor Tunnel level feeding the City's supply lines). According to Rich Martinez, this pump system could provide water through most of the summer and could help augment the base flow in the Judge Tunnel as it decreases through the summer. If this source is to be used, we will have to contact Mine officials to determine status and usability of the pumps in the shaft as well as flow capabilities of the pumps. Water quality would need to be checked, too. Some determination of power costs for running the pumps could be made at that time.

V. Conclusions

There are essentially three areas where significant water is being lost. They again are:

- | | |
|--|---------------|
| 1. The Judge Shaft | 100 gpm |
| 2. 1275 Tunnel Stopes | 50 gpm |
| 3. 1275 Tunnel Cave-ins at old water tunnel | <u>25 gpm</u> |

| | |
|------------------------|---------|
| Approximate total loss | 175 gpm |
|------------------------|---------|

If the present flow is on the order of 600 gallons per minute, then approximately 25 to 30 percent of the flow is being lost due to poor maintenance.

where it is backing up the flow coming from the headwaters approximately 1 and 1/2 feet. The sets and lacing in this area have failed.

- G. Water Lost Down Stope at Junction of No. 1275 Tunnel and New Water Tunnel: The backing up of the water at the No. 9 fault is causing a considerable amount of water loss at the junction of the new water tunnel and the 1275 tunnel. The backed water is seeping down an old stoped out area. It was hard to measure the flow that was being lost, but we could hear the water running through the rocks and on down into the stope. The estimated water loss is on the order of 30 to 50 gallons per minute. However, it would be hard to tell without making measurements above and below the stoped out area with V-notched weirs.
- H. Cave-In Areas at Junction of No. 1275 Tunnel and Old Water Tunnel: The next problem area we encountered was at the junction of the No. 1275 tunnel and the old water tunnel. In this area there are two very substantial caves, the first of which we were able to climb through. This cave-in just below the old water tunnel junction had dammed the water another 1 and 1/2 feet and was sending some of the water down the old water tunnel. It was definitely impeding the flow. There was another cave-in in the 1275 tunnel just above the old water tunnel junction, which is even worse and almost impassable. We did not feel it necessary to go beyond that point and did not attempt to get through this second caved area.

III. Recommendations

The following are our recommendations for possible solutions to the above problems in an effort to help increase the flow in the Judge Tunnel, as well as ensure that the flow is not impeded with future cave-ins.

- A. Entrance Conditions: The two ten-inch pipes, being relatively small in diameter, are somewhat susceptible to more frequent clogging and at times may become so clogged that water is wasted and runs over the tracks and out of the portal without being diverted into the City's water supply. We feel to correct this problem, the following work could be completed:

- C. First Cave-In: The cave near the 1,000 to 1,500 foot station should be mucked out as soon as possible as it could continue to grow. Additional sets and lacing should be installed to help protect this area from future caving.
- D. Judge Shaft: At the Judge Shaft there appears to be approximately 100 gallons per minute being lost. We feel that a collection "funnel" could be constructed using sheet metal and support bracing. This will ultimately direct the water away from the shaft and into the Judge Tunnel supply system. This is presently one of the major sources of water loss.
- E. Old Water Tunnel: No improvements are recommended.
- F. No. 9 Cave-In Area: The No. 9 fault should most certainly be mucked out. We feel that since the No. 9 fault is continually moving, extra strong sets in the form of yielding arched sets and lacing constructed of steel should be installed in this area. The existing wooden sets and lacing have already failed and are only six to eight years old. Another measure that we feel would be very worthwhile taking in this area to protect the supply from the continual caving action would be to place approximately a 30 to 50 foot length of 16-inch steel casing pipe in the channel to allow free flow of the water at all times past the No. 9 fault caving areas. At a 1 percent slope, the 16-inch diameter pipe would have a capacity of 7.5 cfs.
- G. Water Loss Down Slope at Junction of No. 1275 Tunnel and New Water Tunnel: This area should be piped for a length of approximately 100 feet. This would guard against any water loss due to caving in the No. 9 fault area. This pipe also should be a minimum of 16 inches in diameter.
- H. Cave-In Areas at Junction of 1275 Tunnel and Old Water Tunnel: This area needs mucking out and possibly the replacement of some sets and lacing. This area seems to be in the black shale formation similar to the area near the portal. Although the water eventually finds its way through the shale, the caving is impeding the flow and causing some water in the backed pools to seep into bedrock fractures and be lost to the City.

Judge Anchor Tunnel
Water Flow Investigation
April 9, 1982
Page 7

The following immediate measures should be taken to improve and maintain the City's source of supply in the Judge Tunnel:

1. Repair all lagging and other broken mine timbers such that the tunnel is safe and ready for rapid access for maintenance purposes.
2. Muck out all caved areas.
3. Construct the collection funnel in the Judge Shaft to direct that pipe into the main tunnel system.
4. Construct steel sets in the No. 9 fault area.

See enclosed Opinion of Probable Construction Costs for an estimate of repair costs magnitude.

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|------|---------------------------------------|----------|------------|-----------------|
| 8. | Cave-ins at 1275 and old water tunnel | | | |
| | a. Mucking | Job | L.S. | 3,000.00 |
| | b. Wood set replacement | 20 L.F. | 1,000.00 | 20,000.00 |
| 9. | Weir water measurement program | 6 each | 500.00 | <u>3,000.00</u> |
| | Total Construction Cost | | | \$ 98,000.00 |
| | Engineering Services | | | <u>6,000.00</u> |
| | Total Project Cost | | | \$104,000.00 |

- NOTES:
1. All items are furnished and installed.
 2. Item prices are based upon estimated 1982 construction costs.
 3. Since the Engineer has no control over competitive bidding or market conditions, his opinion of probable construction costs provided for herein is made on the basis of his judgement as an Engineer familiar with the construction industry. However, the Engineer cannot and does not guarantee that proposals, bids or the construction costs will not vary from opinions of probable cost prepared by him.

Prepared by: _____
 Checked by: _____
 Dept. Head: _____

FCD:mlb
 (SP BOOK II/JudgAncPCE)

JUDGE ANCHOR TUNNEL
CITY WATER SOURCE

Opinion of Probable Costs
for Maintenance and Improvement

April 7, 1982

| ITEM | DESCRIPTION | QUANTITY | UNIT PRICE | TOTAL COST |
|------|---|----------|------------|-------------|
| 1. | Entrance condition improvements including 75 L.F. of 16-inch diameter steel intake pipe with a new concrete collection box with locking lid | Job | L.S. | \$ 7,000.00 |
| 2. | General mine repair and maintenance, mainly lagging repair and debris cleanup--approximately 500 feet of lagging | Job | L.S. | 7,500.00 |
| 3. | First cave-in muck out and set repair | 10 L.F. | 1,000.00 | 10,000.00 |
| 4. | Judge Shaft collection funnel construction with sheet metal and timber bracing | Job | L.S. | 10,000.00 |
| 5. | Old water tunnel (no repairs recommended) | | | -0- |
| 6. | No. 9 Fault cave-in area: | | | |
| | a. Muck out | Job | L.S. | 1,000.00 |
| | b. Wood set replacement | 15 L.F. | 2,000.00 | 30,000.00 |
| | c. 16-inch diameter steel casing pipe | 30 L.F. | 50.00 | 1,500.00 |
| 7. | Water loss to stope at 1275 and new water tunnels 16-inch diameter steel pipe | 100 L.F. | 50.00 | 5,000.00 |

EXHIBIT

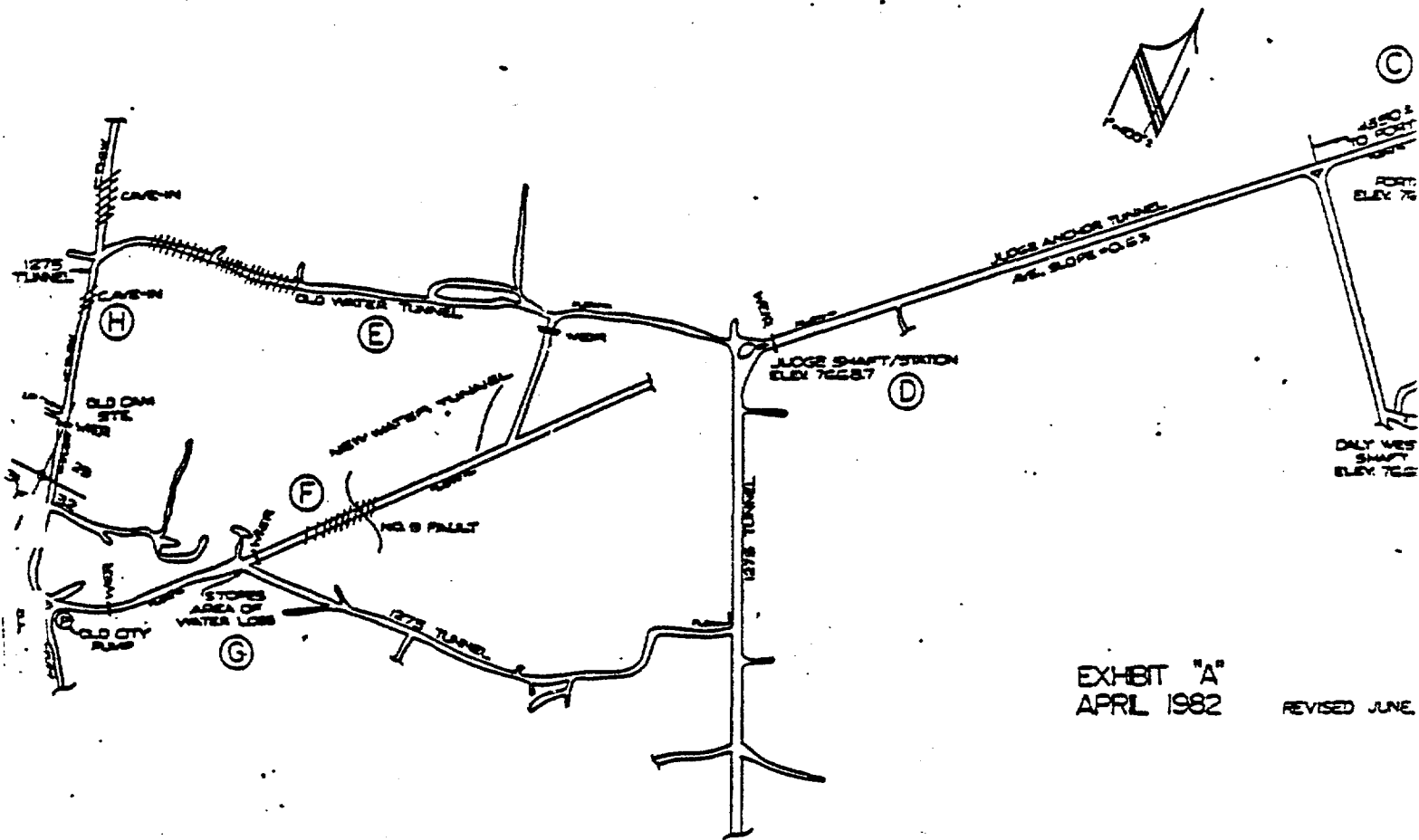


EXHIBIT "A"
APRIL 1982

REVISED JUNE

A-5

UTAH STATE DEPARTMENT OF HEALTH
REQUIREMENTS FOR APPROVALS

Introduction

Letter from Bureau of Public Water Supplies
State of Utah Public Drinking Water Regulations

UTAH STATE DEPARTMENT OF HEALTH
REQUIREMENTS FOR APPROVALS

Introduction

In December, 1974, Congress passed PL93-523, the "Safe Drinking Water Act," which empowered the United States Environmental Protection Agency and the State of Utah with the authority to control public drinking water systems in Utah.

The Bureau of Public Water Supplies in the Division of Environmental Health administers regulations governing the design, construction, and operation of public drinking water systems in Utah. Their recently adopted regulations incorporate all appropriate Federal regulations and any additional requirements deemed necessary by the Utah Safe Drinking Water Committee.

The following letter outlines the history and authority of the Utah State drinking water program and the Bureau of Public Water Supplies. Also included is the cover sheet for the Public Drinking Water Regulations, with which Utah administers its State authority over public water systems.

Mr. Jeff Heden
Page 2
May 28, 1982

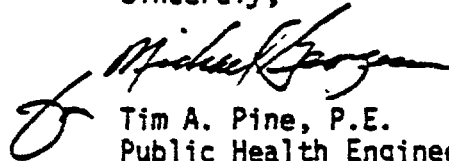
The Committee, which is comprised of 11 members, appointed by the Governor, is essentially the body which adopts and enforces regulations governing the design, construction, and operation of drinking water systems in the State. The Act passed by the State Legislature, in conjunction with the regulations adopted by the Utah Safe Drinking Water Committee, permitted the State to obtain "primacy" for the Federal Act in February of 1980.

Regulations governing the design, construction, and operation of public drinking water systems in Utah are now found in the State of Utah Public Drinking Water Regulations which was originally adopted by the Utah Safe Drinking Water Committee on October 18, 1979. These regulations incorporate all appropriate Federal regulations and additional requirements as deemed necessary by the Utah Safe Drinking Water Committee. Revisions were made to the original regulations on August 28, 1980 and June 25, 1981 in accordance with Utah's rulemaking laws and procedures which include holding public hearings.

The Bureau of Public Water Supplies in the Division of Environmental Health administers these regulations.

If you need any further information in this regard, please contact me.

Sincerely,



Tim A. Pine, P.E.
Public Health Engineer
Bureau of Public Water Supplies

blp

cc: Summit County Health Department

W. M. Matheson
Governor



W. J. Johnson, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS
Injury Health Services
Mental Health
Health Services
Care Financing

OFFICES
Administrative Services
Injury Health Nursing
Community Planning
Health Examiner
Health Laboratory

STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110-2500

Alvin E. Rickers, Director
Room 474 801-533-6121

May 28, 1982
533-4207

Jeff Heden
J. J. Johnson and Associates
Park Meadows Plaza
Park City, Utah 84060

Dear Mr. Heden:

Re: History of State Drinking
Water Program

Per your request, we hereby outline the development of the State's
Public Drinking Water Regulations.

The involvement of the State Health Department in overseeing public
drinking water supplies specifically goes back to 1953 and earlier
under general health laws. Section 26.15.5 of the Utah Code at
that time empowered the Board of Health to establish regulations
governing the design and construction of public drinking water
systems. The adopted regulations and standards essentially used
as criteria were the Ten States Standards and the Public Health
Service Standards.

On December 16, 1974 Congress passed PL93-523, referred to as the
"Safe Drinking Water Act". This act empowered the United States
EPA to establish regulations with respect to the delivery of safe
drinking water in the United States. This act also permitted
states to assume primary responsibility for enforcing the Federal
regulations if they met certain minimum requirements. This
assumption of primary enforcement responsibility is referred to
as "Primacy".

Under the authority of the Safe Drinking Water Act, the United
States EPA published in the Federal Register of December 24, 1975,
the National Interim Primary Drinking Water Regulations. These
regulations established maximum contaminant levels, sampling
frequencies, reporting and record keeping requirements (various
amendments and additions to these have been added since).

In order to obtain primacy for the enforcement of the Federal
drinking water regulations, the Utah Legislature in 1979 passed
the Utah Safe Drinking Water Act. Among the major provisions of
the Act was the formation of the Utah Safe Drinking Water Committee.

- 3.2 Secondary Drinking Water Regulations
- 3.3 Unmonitored Contaminants
- 3.4 Definitions

4. MONITORING, TREATMENT, REPORTING AND RECORD KEEPING

- 4.0 General
- 4.1 Exemptions from Monitoring Requirements
- 4.2 Approved Laboratories and Acceptable Analytical Methods
- 4.3 Monitoring of Water Quality
- 4.4 Reporting Test Results
- 4.5 Record Maintenance
- 4.6 Definitions

PART II - DESIGN AND CONSTRUCTION STANDARDS

5. QUANTITY REQUIREMENTS

- 5.0 General
- 5.1 Community Water Systems
- 5.2 Non-Community Water Systems

6. SOURCE DEVELOPMENT

- 6.0 General
- 6.1 Surface Water
- 6.2 Ground Water - Wells
- 6.3 Ground Water - Springs

7. DISINFECTION

- 7.0 General
- 7.1 Siting
- 7.2 Chlorination
- 7.3 Iodination
- 7.4 Ozonation
- 7.5 Ultraviolet Light

8. CONVENTIONAL COMPLETE TREATMENT

- 8.0 General
- 8.1 Plant Siting
- 8.2 Plant Capacity and Reliability Assurance
- 8.3 Color Coding and Pipe Marking
- 8.4 Diversion Structures and Pretreatment
- 8.5 Chemical Addition
- 8.6 Mixing
- 8.7 Sedimentation
- 8.8 Solids Contact Unit
- 8.9 Filtration
- 8.10 In-Plant Finished Water Storage
- 8.11 Miscellaneous Plant Facilities
- 8.12 Operation and Maintenance Manuals
- 8.13 Safety
- 8.14 Disinfection Prior to Use
- 8.15 Disposal of Treatment Plant Waste

9. MISCELLANEOUS TREATMENT

- 9.0 General
- 9.1 Deionization
- 9.2 Fluoridation
- 9.3 Direct Filtration
- 9.4 Taste and Odor Control
- 9.5 Softening
- 9.6 Stabilization
- 9.7 Iron and Manganese Control
- 9.8 Aeration
- 9.9 New Water Treatment Processes or Equipment

10. PUMPING FACILITIES

- 10.0 General
- 10.1 Location
- 10.2 Pumping Stations
- 10.3 Pumps
- 10.4 In-Line Booster Pumps

- 10.5 Automatic and Remote Controlled Stations
- 10.6 Appurtenances
- 10.7 Hydropneumatic Systems
- 10.8 Disinfection

11. WATER STORAGE

- 11.0 General
- 11.1 Sizing
- 11.2 Location of Reservoirs
- 11.3 Design
- 11.4 Disinfection

12. DISTRIBUTION SYSTEM

- 12.0 Water Main Design
- 12.1 Materials
- 12.2 Separation of Water Mains and Sewers
- 12.3 Air Relief Valves: Valve, Meter and Blow-off Chambers
- 12.4 Installation of Water Mains
- 12.5 Cross Connections and Interconnections
- 12.6 Water Hauling
- 12.7 Service Connections and Plumbing

A-6 WATER USE AT VAIL, COLORADO, 1971-1973

WATER USE AT VAIL, COLORADO, 1971-1973*

| Item | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual Use (gpcd) |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------------------------|
| Percent Occupancy | 90 | 90 | 90 | 75 | 45 | 60 | 70 | 70 | 60 | 50 | 75 | 100 | 73 |
| <u>1971</u> | | | | | | | | | | | | | |
| Estimated Occupancy(%) | 57 | 57 | 57 | 43 | 28 | 38 | 44 | 44 | 38 | 37 | 55 | 74 | 48 |
| Total Use (MG) | 18.5 | 18.0 | 23.5 | 18.5 | 12.5 | 20.0 | 30.0 | 29.0 | 17.0 | 14.0 | 16.5 | 21.0 | 238 |
| Daily Use (gpcd) | 105 | 113 | 133 | 143 | 144 | 175 | 220 | 213 | 149 | 122 | 100 | 92 | 136 |
| <u>1972</u> | | | | | | | | | | | | | |
| Estimated Occupancy(%) | 66 | 66 | 66 | 55 | 33 | 44 | 52 | 52 | 44 | 39 | 59 | 78 | 54 |
| Total Use (MG) | 18.5 | 19.5 | 21.5 | 13.5 | 15.5 | 23.0 | 35.5 | 26.5 | 16.5 | 12.0 | 24.5 | 27.5 | 254 |
| Daily Use (gpcd) | 90 | 102 | 105 | 82 | 152 | 174 | 220 | 164 | 125 | 99 | 138 | 114 | 129 |
| <u>1973</u> | | | | | | | | | | | | | |
| Estimated Occupancy(%) | 70 | 70 | 70 | 58 | 35 | 47 | 55 | 55 | 47 | 45 | 67 | 90 | 59 |
| Total Use (MG) | 24.9 | 22.2 | 24.4 | 14.2 | 9.1 | 17.1 | 26.4 | 32.1 | 26.9 | 15.6 | 14.9 | 25.4 | 253 |
| Daily Use (gpcd) | 115 | 113 | 112 | 82 | 84 | 121 | 155 | 188 | 191 | 112 | 74 | 91 | 118 |
| <u>1971 -1973</u> | | | | | | | | | | | | | |
| Average Daily Use (gpcd) | 103 | 109 | 117 | 102 | 127 | 157 | 198 | 188 | 155 | 111 | 104 | 99 | 128 |

* Reprint of Table 3, Reference 16 in Appendix 7, List of References.

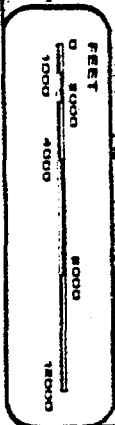
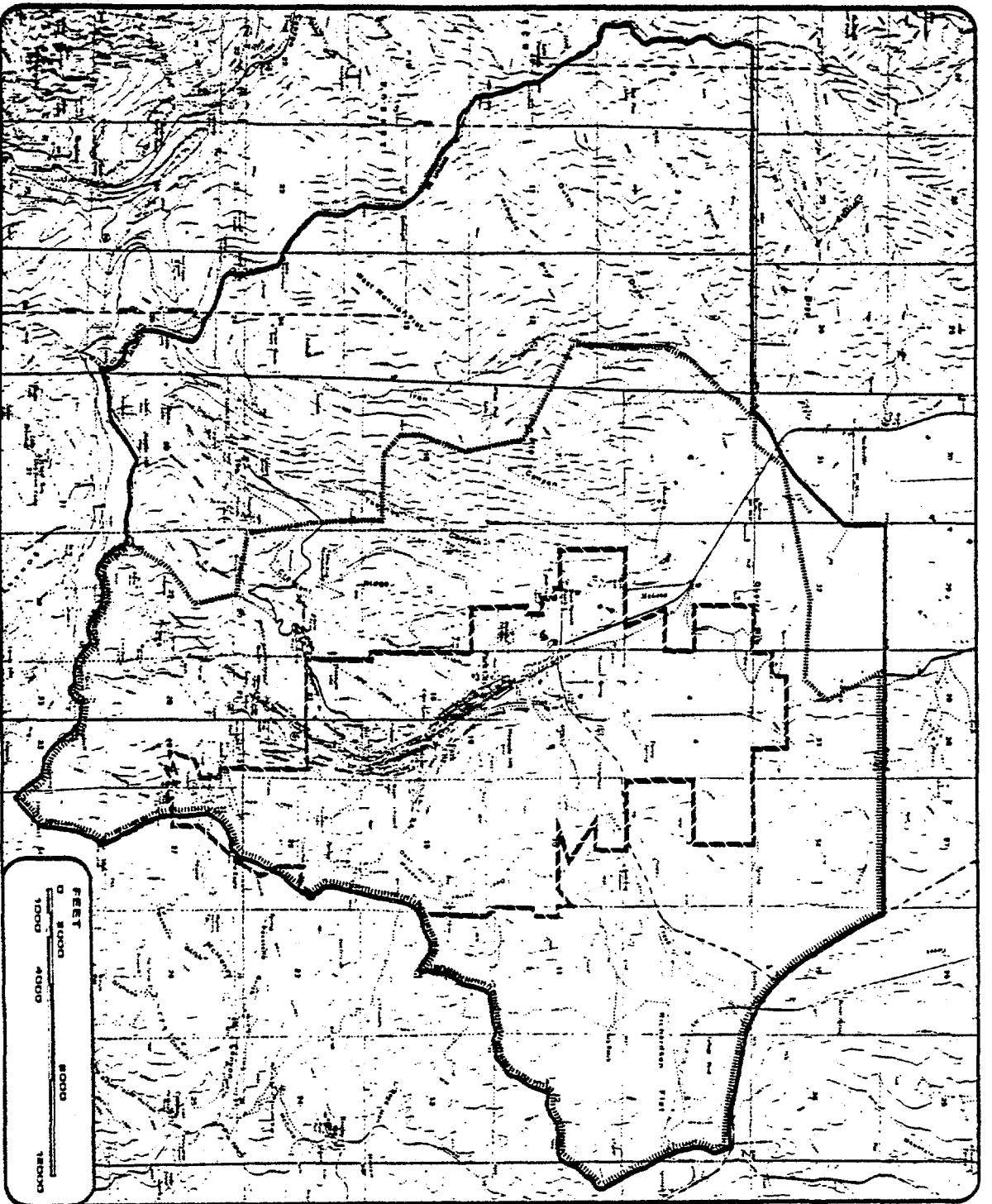
A-7 LIST OF REFERENCES

LIST OF REFERENCES

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PARK CITY SERVICE AREAS

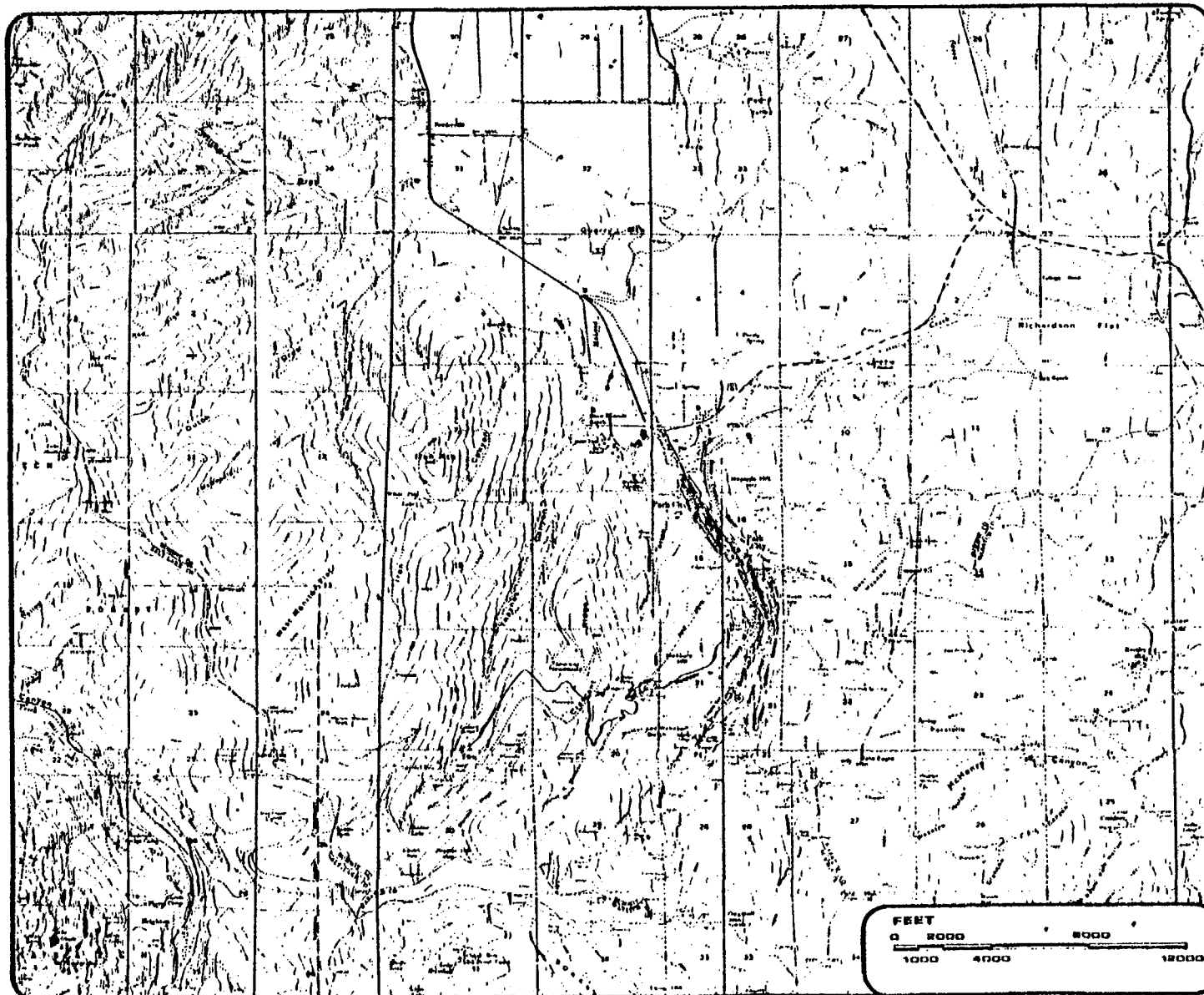
LEGEND

- 1982
PARK CITY
LIMITS
- ADOPTED
ANNEXATION
BOUNDARY
- LONG-RANGE
SERVICE AREA

PARK CITY • WATER RESOURCES STUDY

0 4000
EXHIBIT 1

NORTH



POINT OF DIVERSION LOCATIONS

LEGEND

WELL

SPRING

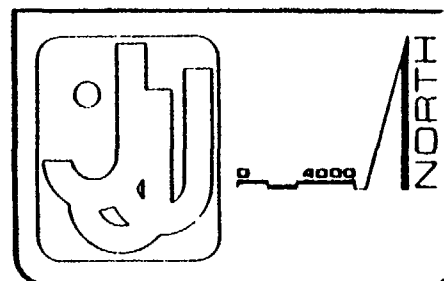
MINE SOURCE

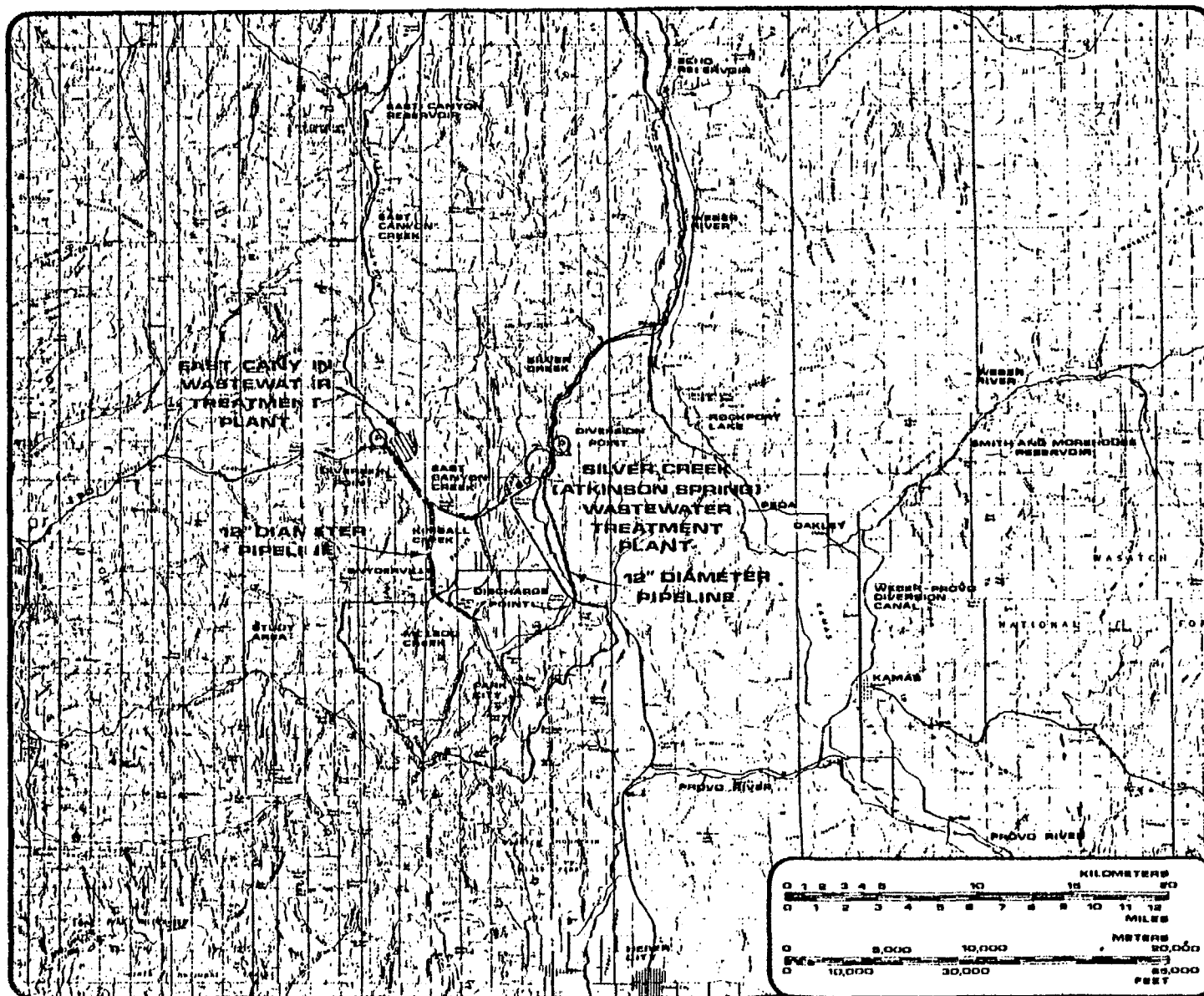
EXCHANGE
APPLICATION NUMBER

WEBER RIVER
DECREE NUMBER

CHANGE
APPLICATION NUMBER

PARK CITY • WATER
RESOURCES STUDY









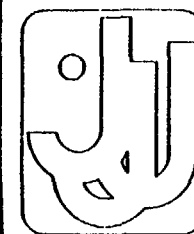
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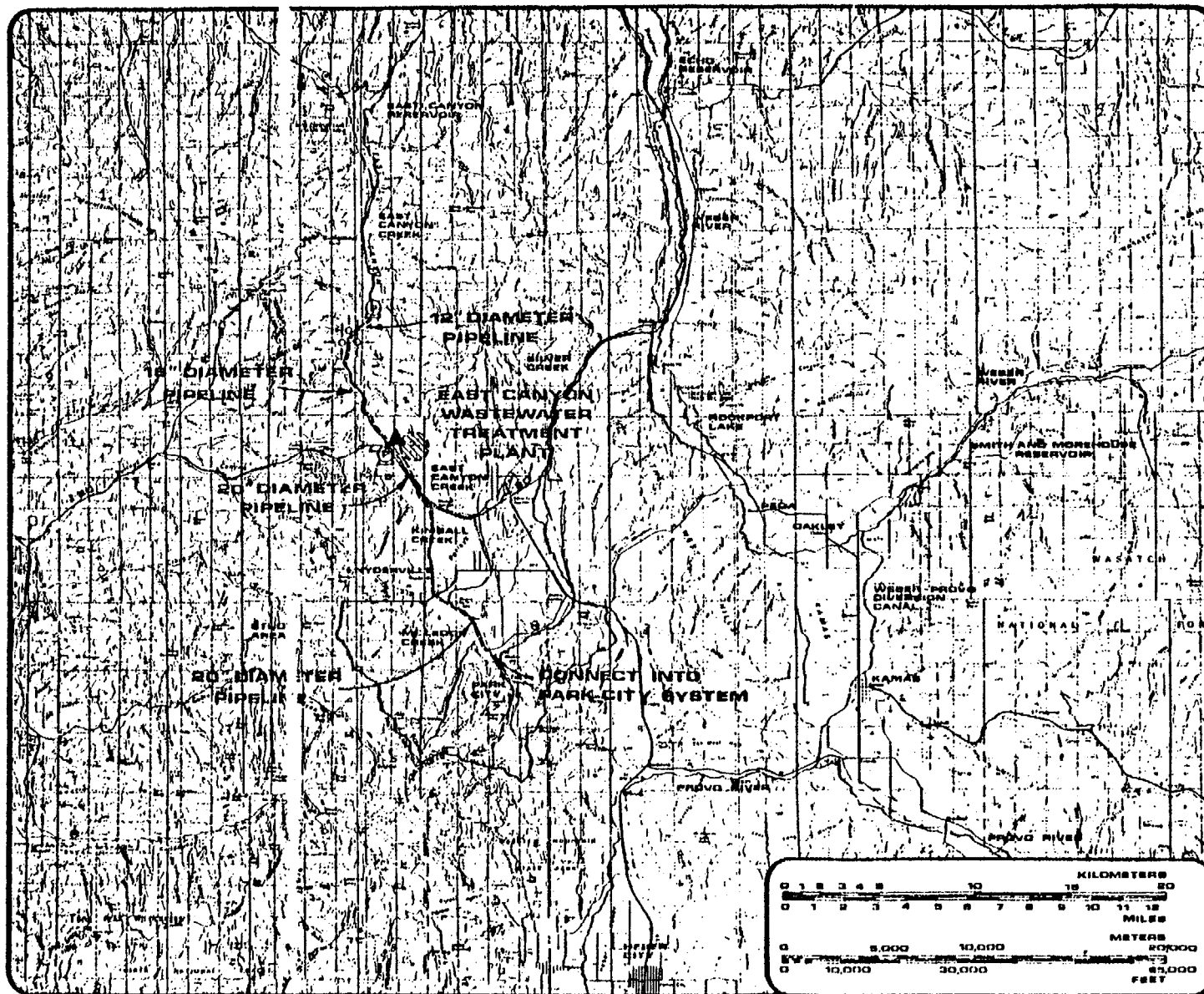
RECYCLE S.B.S.I.D. WASTEWATER EFFLUENT

LEGEND

-  EXISTING WASTEWATER TREATMENT PLANT
-  POTENTIAL WASTEWATER TREATMENT PLANT
-  POTENTIAL PUMP FACILITY
-  WATER TRANSMISSION PIPELINE

PARK CITY • WATER RESOURCES STUDY










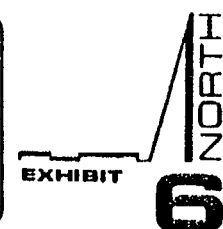
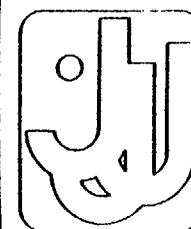
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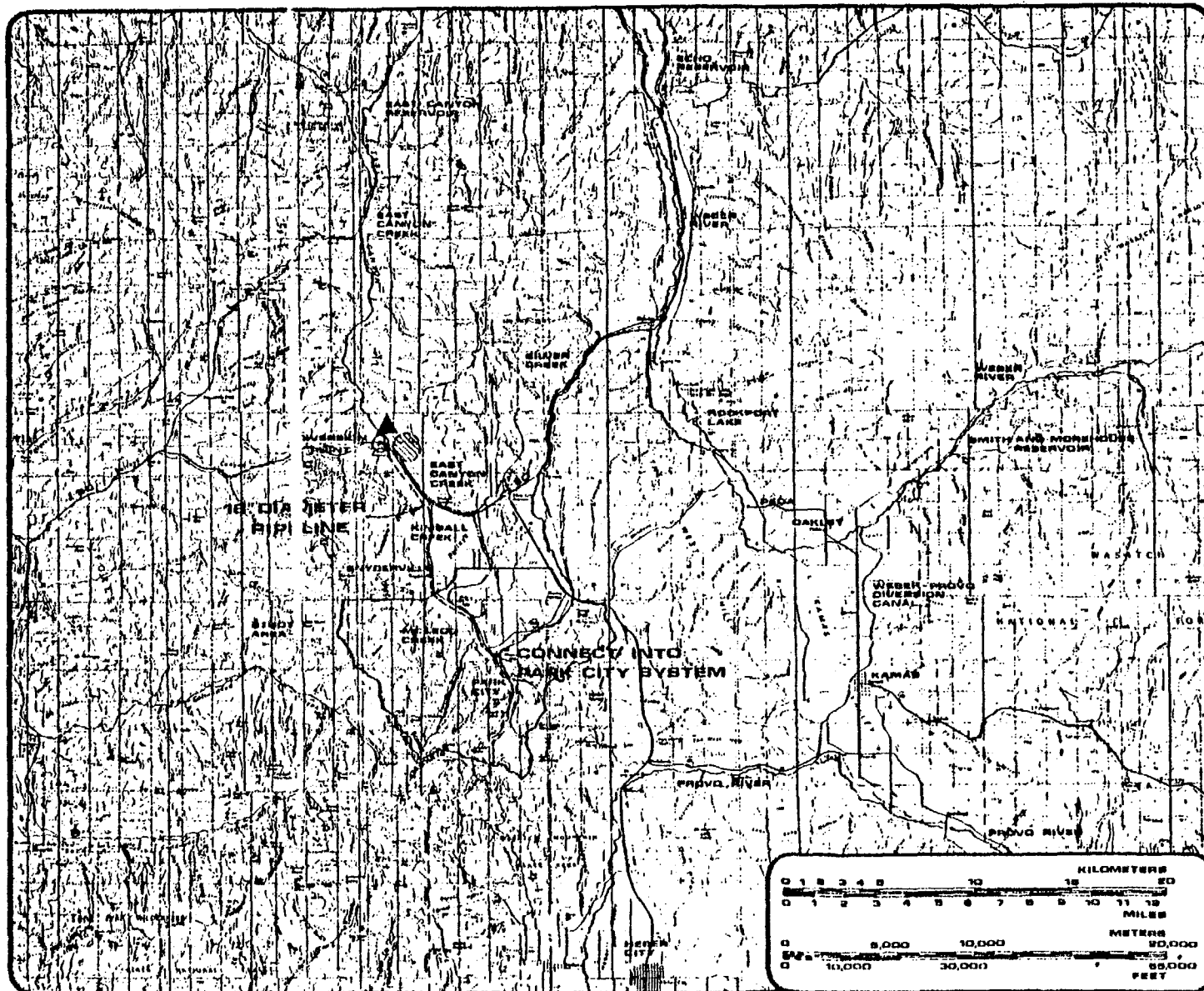
EAST CANYON SPRINGS TRANSMISSION PIPELINE

LEGEND

-  EXISTING WASTEWATER TREATMENT PLANT
-  POTENTIAL WATER TREATMENT FACILITY
-  POTENTIAL PUMP FACILITY
-  WATER TRANSMISSION PIPELINE
-  POTENTIAL WELL SITE

PARK CITY • WATER RESOURCES STUDY









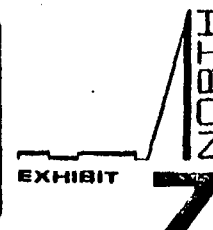
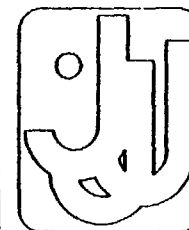
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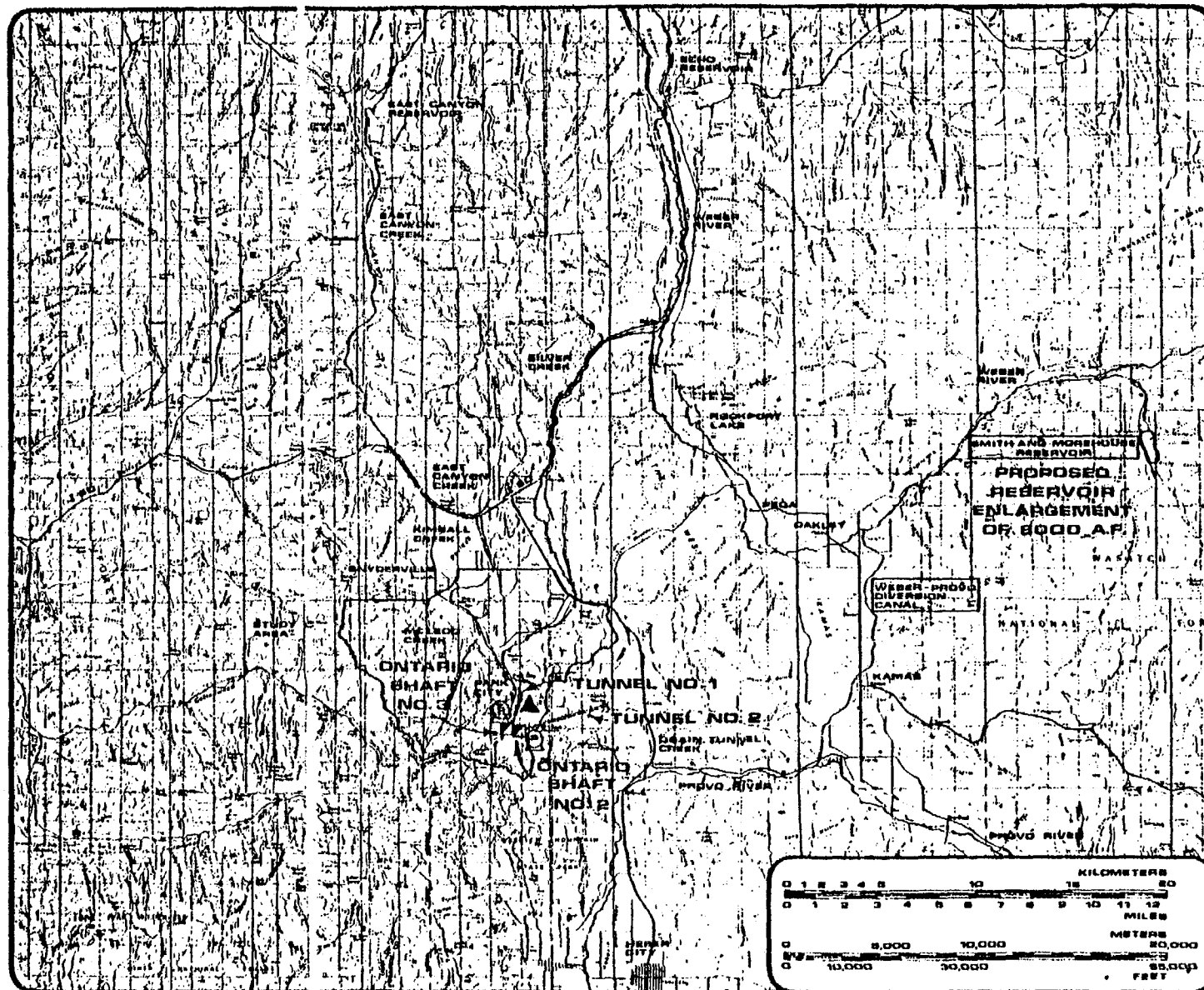
EAST CANYON CREEK TRANSMISSION PIPELINE

LEGEND

-  EXISTING WASTEWATER TREATMENT PLANT
-  POTENTIAL WATER TREATMENT FACILITY
-  POTENTIAL PUMP FACILITY
-  WATER TRANSMISSION PIPELINE

PARK CITY • WATER RESOURCES STUDY









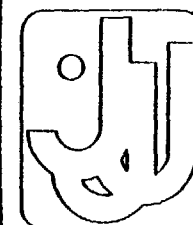
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SMITH AND MOREHOUSE WATER EXCHANGE

LEGEND

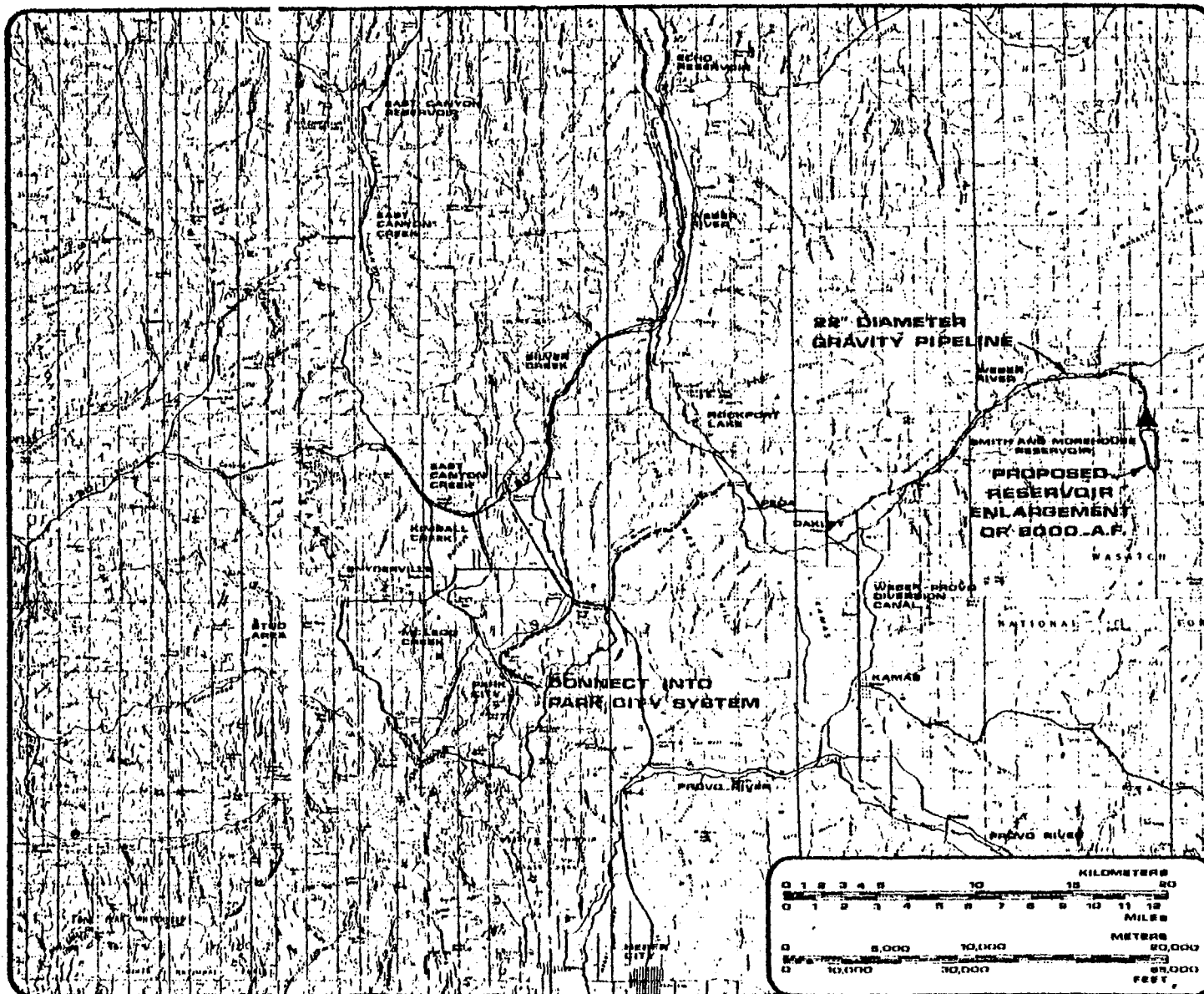
-  POTENTIAL WATER TREATMENT FACILITY
-  POTENTIAL PUMP FACILITY
-  MINING SHAFT
-  DRAIN TUNNEL

PARK CITY • WATER RESOURCES STUDY



EXHIBIT



NORTH
8



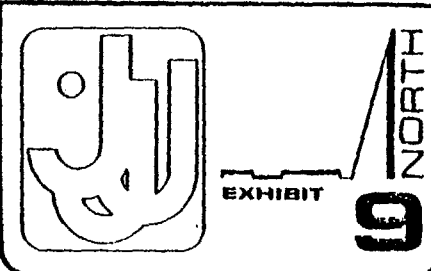
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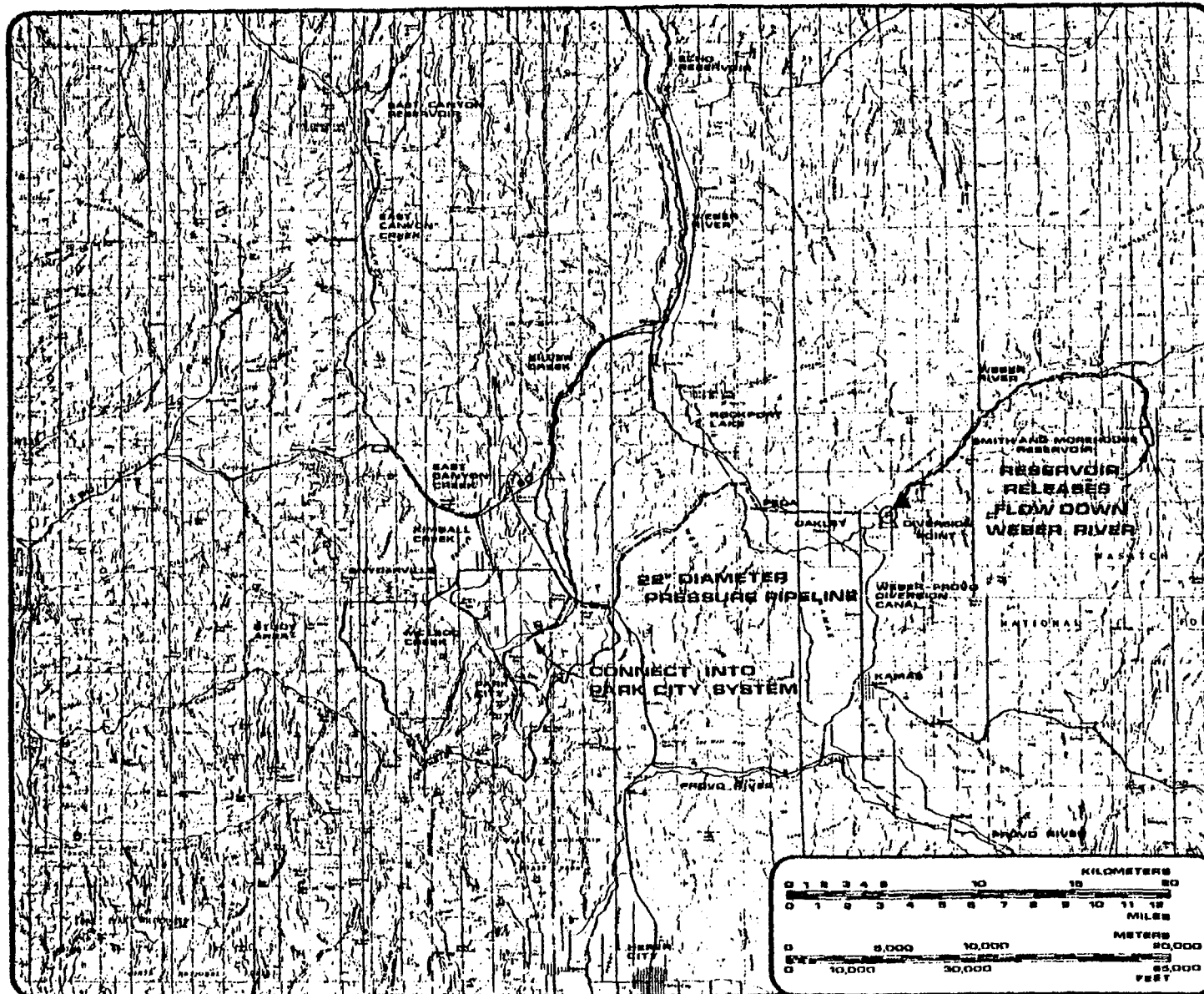
SMITH AND MOREHOUSE TRANSMISSION PIPELINE

LEGEND

-  **POTENTIAL WATER
TREATMENT FACILITY**
-  **WATER TRANSMISSION
PIPELINE**

PARK CITY • WATER RESOURCES STUDY









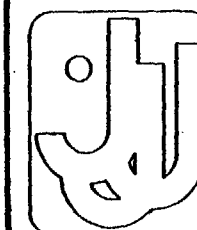
ALTERNATIVE 7

WEBER RIVER/ OAKLEY TRANSMISSION PIPELINE

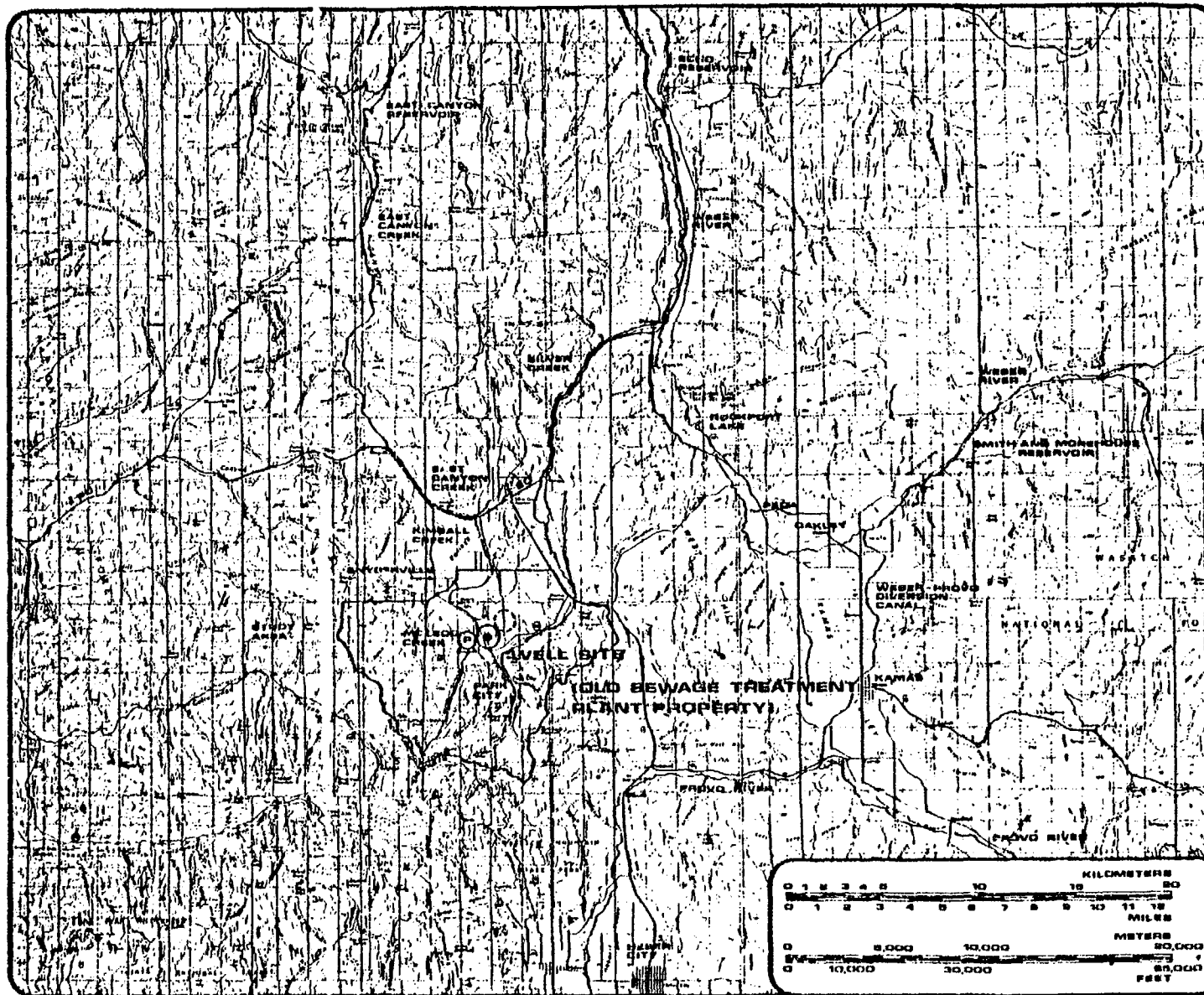
LEGEND

-  POTENTIAL WATER TREATMENT FACILITY
-  POTENTIAL PUMP FACILITY
-  WATER TRANSMISSION PIPELINE
-  WEBER RIVER

PARK CITY • WATER RESOURCES STUDY



NORTH
EXHIBIT 10



ALTERNATIVE 8

PARK MEADOWS WELL NO. 2

LEGEND

- ⊙ POTENTIAL WELL SITE
- ⊗ POTENTIAL PUMP FACILITY
- EXISTING WELL AND PUMP

PARK CITY • WATER RESOURCES STUDY

